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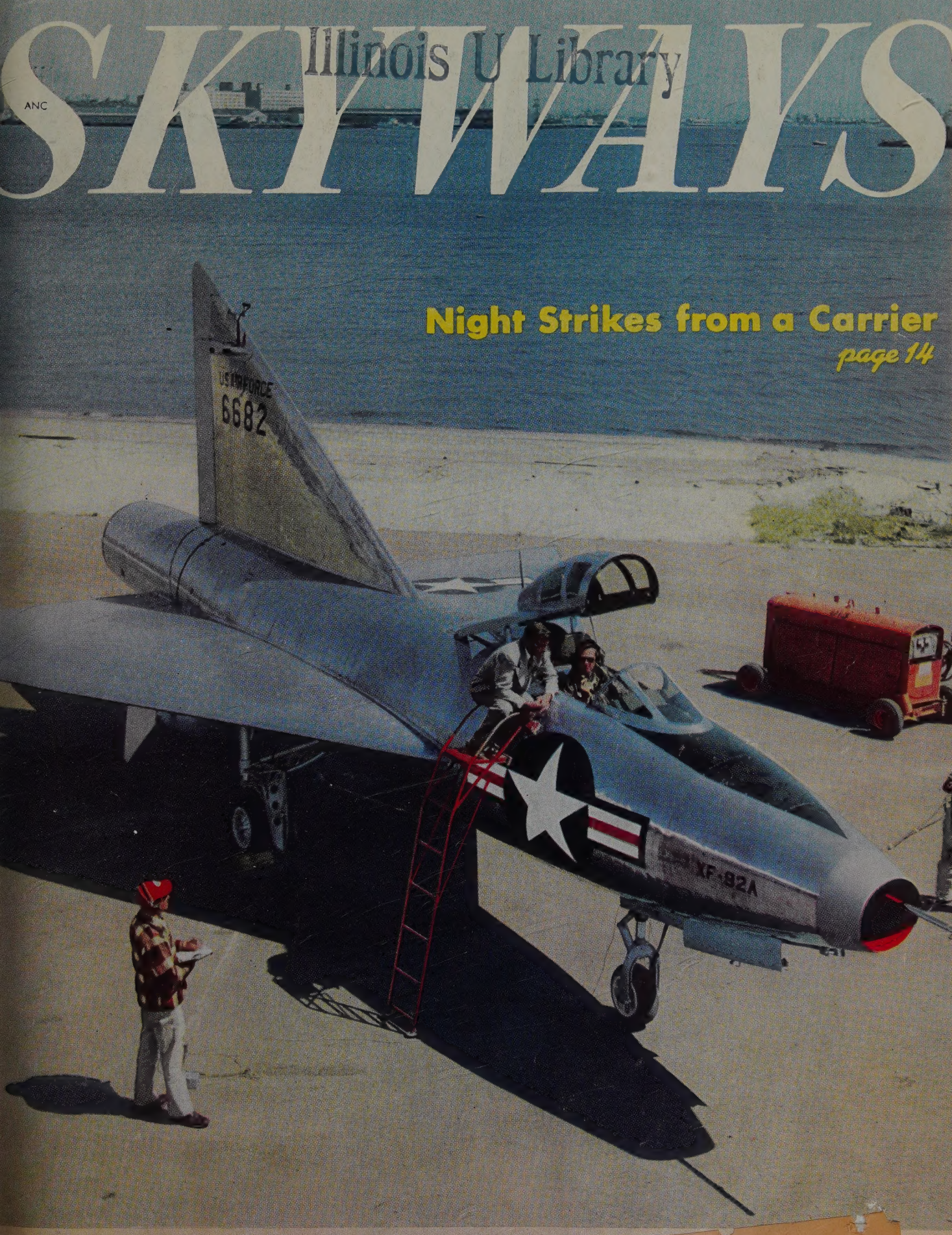

Night Strikes from a Carrier

page 14

Which will it be, GCA or ILS?

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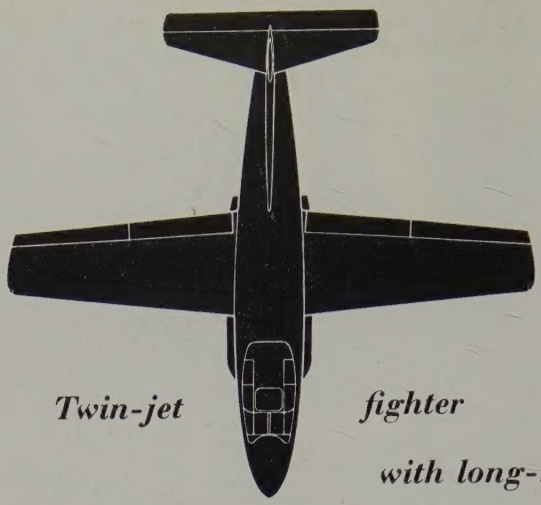
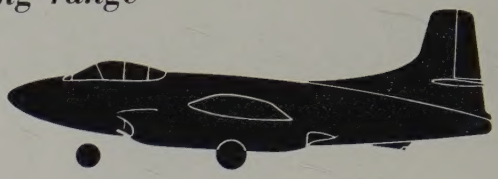


Twin-jet *fighter* *with long-range* *radar eyes*



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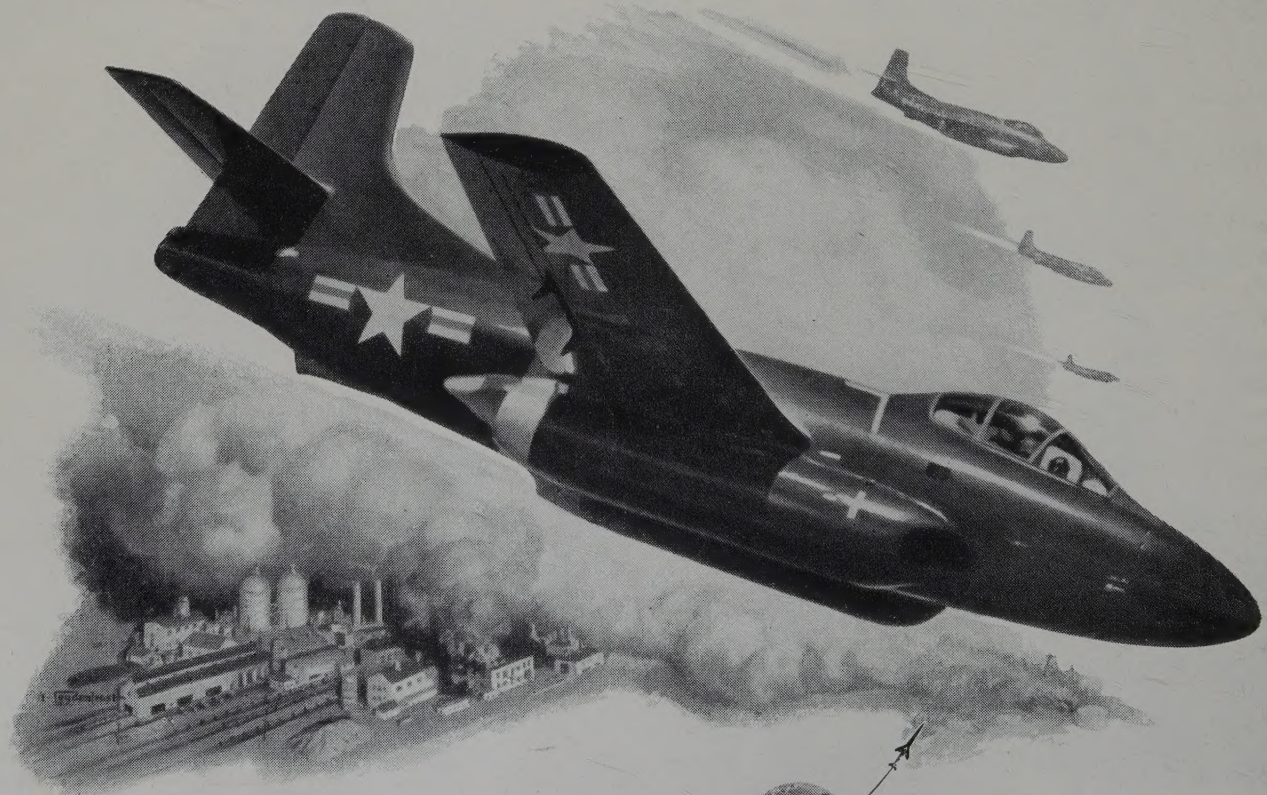

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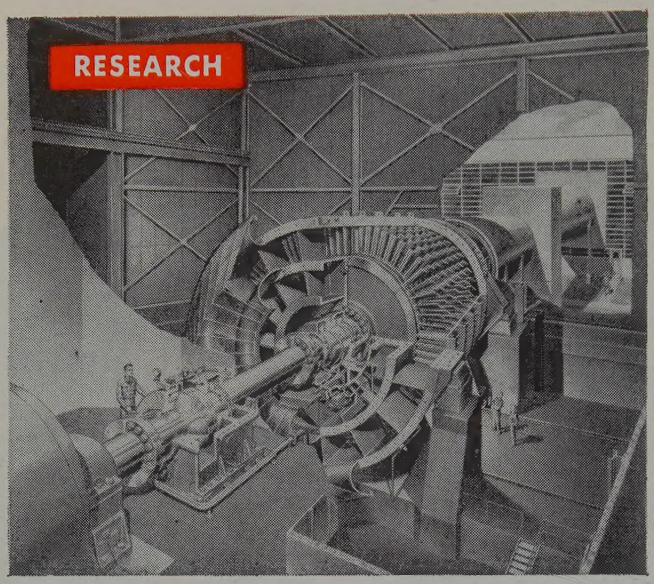

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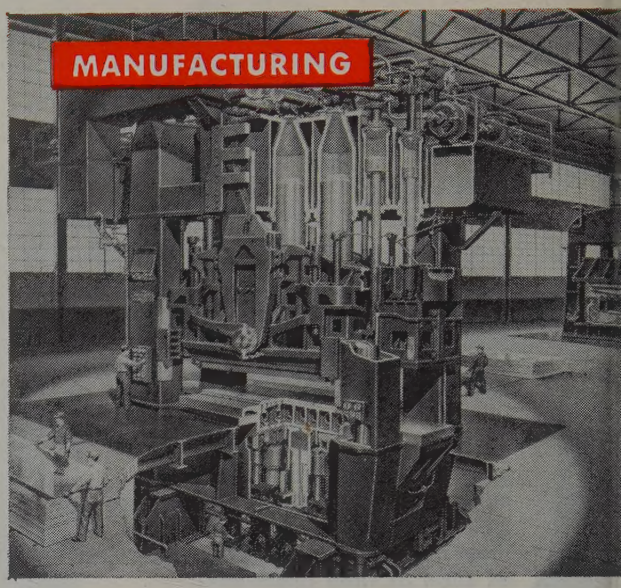

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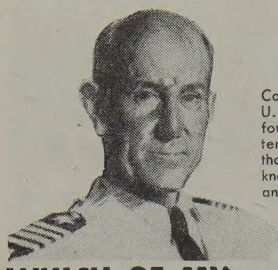

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AIR YOUR VIEWS

Torque Talk

Gentlemen:

Why is it that a great many pilots insist on describing the tendency of an airplane, with tail wheel undercarriage, to turn or swing on take-off and landing as torque? Surely they mean the turning effect of the revolving slipstream from the propeller on the fin and rudder. And this, in many cases, in conjunction with the gyroscopic tendency of a heavy prop precessing when the tail is raised or lowered. These two factors work together on take-off, whereas only the precession of the propeller has a noticeable influence during the landing run when lowering the tail after the wheels are supporting the weight of the airplane.

Torque is the tendency of an airplane to revolve or roll in the opposite direction to the propeller. The only airplane I know of and have flown that this torque bothers is the *Spitfire* and *Seafire* series. One oleo would be compressed slightly, due to the narrow track. If this added drag on one wheel had any turning effect, it would be in the opposite direction to that caused by the slipstream and precession.

A twin-engined airplane, *i.e.* the de Havilland *Hornet*, with its propellers rotating in opposite directions, and a single or twin-engined airplane with contra-rotating propellers on a common shaft or axis, *i.e. Wyvern*, create torque . . . and lots of it, but they cancel out the deleterious effects of slipstream and precession, and consequently have no swinging or turning on take-off or landing.

F/LT. GEO. B. COLLINGE
RCAF, Ret.

North Hollywood, Calif.

Prop Tracking

Gentlemen:

With the article, "Props Are Not Expendable," you have a picture showing how to check the prop blade track by means of a stick driven into the ground. This method is not too reliable. When we check a prop blade track, we hold the stick to the ship instead of driving it into the ground. When the stick is in the ground and you pull the prop over, the ship may move more than the permissible amount. When the stick is on the ship, if the ship moves so does the stick.

ED. CARTER

Thorofare, N. J.

Mig Salvage

Gentlemen:

In a recent issue you stated that a Mig was shot down by U.N. forces and was salvaged for study by the Navy. Could you not have given credit where credit was due and informed your numerous readers that it was the British Royal Navy that recovered the aircraft, virtually from under the noses of the North Korean shore gunners, afterward turning the complete machine over to the Air Materiel Command for examination.

A. N. MENEAR

Toronto, Canada

Thank you for that information, Mr. Menear. Please be assured that had we known it was the British Navy, credit for the salvage would have been so given.—ED.

Flying Flapjack

Gentlemen:

Could you please tell me what happened to the Navy's XF5U-1, the Flying Flapjack? I have not heard anything about it in some time. I wonder if this plane could have any connection with the flying saucer mystery? A picture of the XF5U was printed in connection with the flying saucer business.

J. FAMPLIN

New York, N. Y.

The photograph you refer to is of the Chance Vought V-173, a low-powered full-scale test model of the XF5U-1. In late 1949 or early 1950 the XF5U-1 was being prepared for test flying by the USAF. However, no photograph of the actual plane was ever released. According to the last word this office received, work on the XF5U-1 had been abandoned. Its full-scale model, the V-173, first flew in 1942, and there are several who believe that this model was mistaken on one occasion for a flying saucer.—ED.

Airliners

Gentlemen:

Early in 1945 several new airliners were proposed for production at the end of the war. Most of these have never appeared. Could you tell me what has happened to the Douglas DC-7, the Martin *Leviathan*, and the Convair 37? At that time the DC-7 and the Convair 37 were supposedly on order by Pan American Airways. I believe the 37 is the transport version of the C-99. Also, what was done with the Boeing *Clippers* after they were taken out of service and how many of these ships were built?

A. THOMAS

Long Beach, Calif.

The DC-7 was a four-engined transport, 26 of which were ordered by Pan American. When that order was cancelled, the only contract for production was that of the Air Force. Military designations of the DC-7 are C-74 and C-124A. At the end of the war, the military contract for this ship was cut back, but 26 were on order as of the end of 1949 The Convair 37 is Consol dated Vultee's manufacturers designation of the B-36, the transport version of which is the Air Force's C-99. The Martin Company's so-called Leviathan *never went beyond artist's drawings of a large flying boat transport. The Boeing* Clippers *were sold to companies in various parts of the world, mostly South America, where they are said to be in service as cargo transports.*—ED.

Able Mable

Gentlemen:

In a recent issue you mentioned that Naval Air Reservists were flying the *Able Mable* dive bomber. I don't recall ever seeing a picture or the specifications of this airplane. I also have a request regarding the many different planes the U. S. Army Field Forces use for aerial observation. Has a recent article on this subject been printed. I believe all readers of your magazine would like to see such a piece. These planes used to be flown by the U. S. Army Air Forces, of which I was a member during World War II, Ninth AF, to be exact.

PFC. EARL WIGINGTON

Ft. Sill, Okla.

Able Mable *is the Martin AM-1, a single-seat attack bomber powered by 3,000-hp Pratt & Whitney* Wasp Major. *It is armed with four 20-mm cannon and carries three 2,000-pound torpedoes and 12 five-inch rockets. It has a top speed of about 300 mph and a maximum range of over 1300 miles. SKYWAYS has featured several articles dealing with the liaison planes flown by the Army, the most recent one, "Combat Chasers," was in the February, 1952 issue.*—ED.

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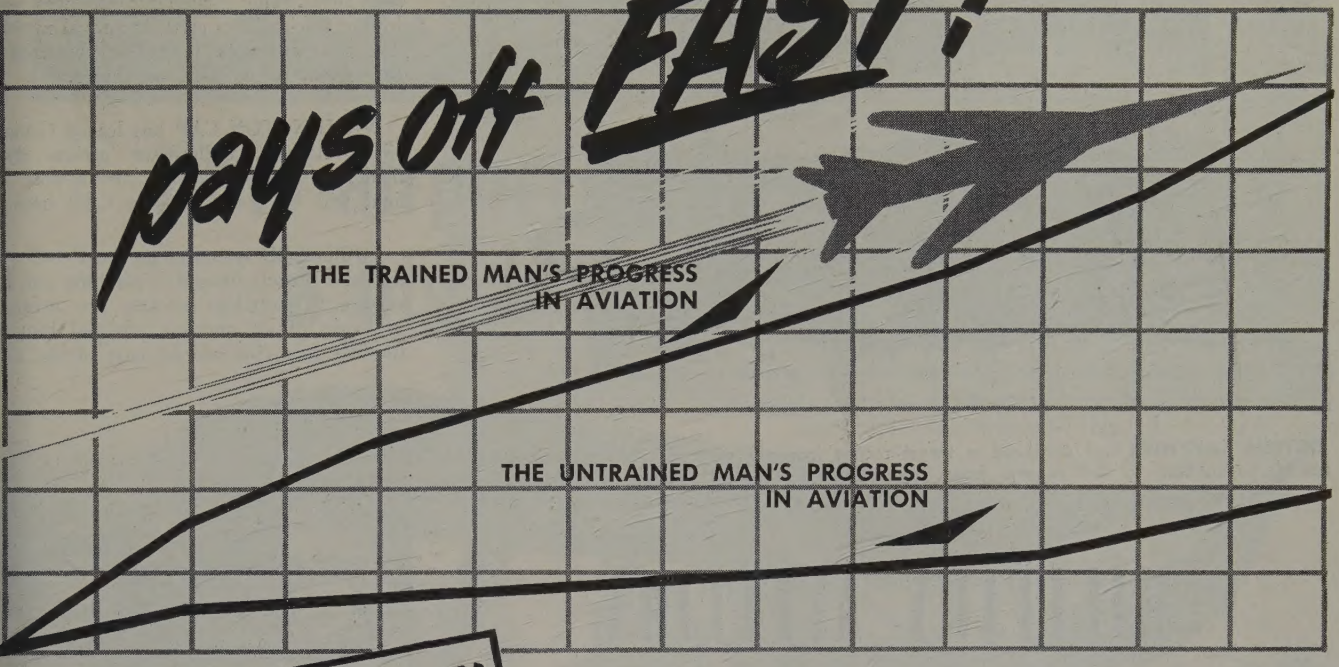

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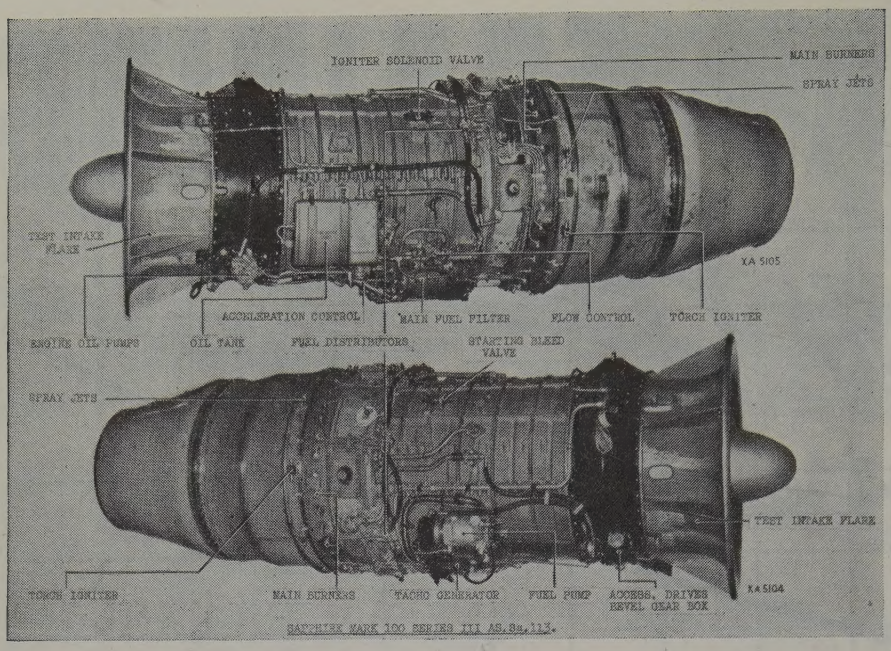


BRITISH SAPPHIRE has achieved a thrust rating increase of from 7800 pounds to 8300 pounds, according to test reports from England. Photo *(above)* shows both sides of unit

MILITARY AVIATION

Sapphire Thrust Up

A recent announcement from England reports the British *Sapphire* engine has achieved a thrust of 8300 pounds. This increase in thrust rating, from 7800 to 8300 pounds, has been attained without the slightest increase in engine weight or size. Although the full results of the *Sapphire* test are not yet known, it has been indicated that complete British experimental data is being placed at the disposal of American manufacturers of the engine, and the greatly increased thrust will be embodied in all future production of the jet unit. In the United States, Curtiss Wright and the Buick Division of GM are building the *Sapphire*. This jet engine will be used to power the Martin-built *Canberra* and the Republic *Thunderjet*.

Marlin Joins Fleet

The first 36-ton P5M-1 *Marlin*, seaplane patrol bomber built by Glenn L. Martin Company, has gone into service with the Atlantic Fleet Air Force. An anti-submarine weapon, the *Marlin* is expected to gradually replace the Martin PBM *Mariner* now in action throughout the Fleet and in Korean waters.

Gyrodyne Test Flights

Successful flights in all helicopter maneuvers were completed recently by the Gyrodyne co-axial helicopter. The Gyrodyne 'copter can carry a pilot, a medical attendant and three litter patients internally. More compact than other 'copters, the Gyrodyne features fewer parts, simple control and a higher payload in proportion to its gross weight. Main feature claimed for the Gyrodyne helicopter is its ready adaptability to a convertiplane, a prototype of which was flown by Gyrodyne in 1949.

Thunderjets

Two Republic F-84G *Thunderjets* based in Virginia dropped practice bombs over California on a target at the halfway point of a 4,775-mile non-stop round-trip refueled flight across the States. The jet fighter-bombers took off from Langley Air Force Base, dropped their practice bombs at Edwards AFB, Muroc, Calif., then flew back to Langley. The time of flight was 11 hours and 17 minutes for one of the F-84G's and 11 hours, 20 minutes for the other. The *Thunderjets* were refueled, enroute to their target, over Memphis, Tennessee, by KB-29 tankers, and were again refueled on the way back to Langley. The pilots were Capt. John P. Flynn and Capt. Robt. E. Wayne.

News Notes

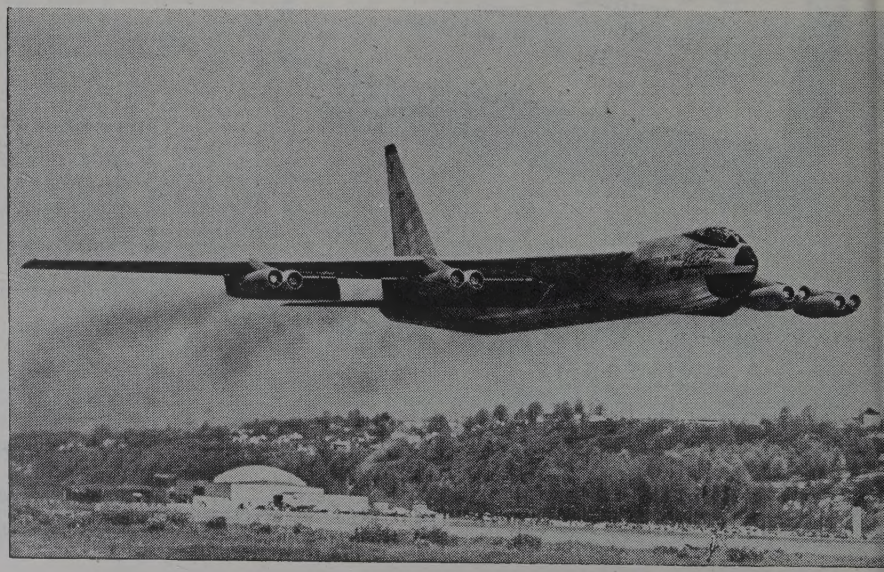
TEMCO AIRCRAFT CORPORATION now the official name of Texas Engineering and Manufacturing Company, Inc., of Dallas, Texas. The change recently was voted by the stockholders at their annual meeting. The company has long been referred throughout the industry as Temco.

WASHINGTON CAP has leased Congressional Airport, well-known private flying field near Washington, D.C., for a year. The field will be operated as a CAP base.

LOCKHEED is equipping the F-94C *Starfire* with rockets instead of machine gun and cannon. Twenty-four rockets are arranged in banks of six and are recessed into the fuselage in a ring around nose of the F-94

PILOT and copilot of YB-52's first flight were Tex Johnson *(right)*, Lt. Col. Townsend

STRATOFORTRESS, the new eight-jet heavy bomber built by Boeing, made its first flight recently. The USAF jet bomber stayed aloft two hours, 51 minutes; has since had several hour

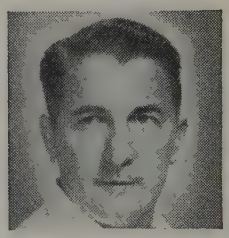


PLANE FAX

Quick picture of
PETALUMA SKY RANCH
Petaluma, California

2200' graded runway, lighted on request . . . snack bar . . . fireside lounge . . . free transportation to Petaluma . . . CAA-approved flight school and flight examiner . . . near Valley of the Moon resort area . . . complete *Standard Oil Aviation Service.*

How airports do a big community job



George Justman, of Justman Flying Service at Petaluma, knows from experience how important airports have become to the communities they serve. He tells this story:

Businessmen find airport facilities valuable.

Student Pilots relax in the flight lounge.

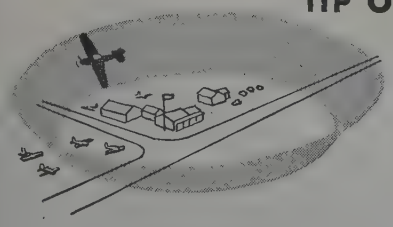
Air Scouts keep pace with our air age.

"Here at Petaluma, we have a true community airport. Along with student pilots and others who fly for pleasure, we have flying farmers, hay and grain buyers, chicken ranchers and other businessmen using our facilities. They've discovered that a community airport helps them to do more business quickly and with enjoyment. And we make sure of dependable performance in the planes they use by servicing them with Standard aviation products. In my 8,000 hours of flying, I've never used any aviation gasoline that gives the consistently high performance of Chevron 80/87 Aviation Gasoline, or any oil that keeps engines as clean as RPM Aviation Oil.

"On Air Scout Day each year, a lot of people from the community come out to see their airport in operation. And many of them are surprised at how important flying has become to a wide variety of businesses. But they are not surprised to find that flyers, too, use 'Chevron' and 'RPM.' On the ground and in the air these two brand names mean quality and dependability wherever you go in the West."

T.M.'S "RPM," "CHEVRON," REG. U.S. PAT. OFF.

TIP OF THE MONTH



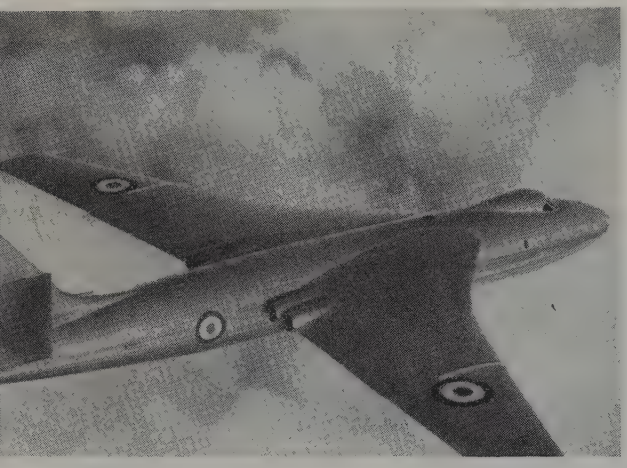
Circle all fields before you land (especially airports that are not radio controlled) at least 500 feet above the traffic pattern. Study the landing conditions, and pay attention to signals. It helps prevent accidents, and will save you coming in on a field that is closed or under repair.

CHEVRON AVIATION GASOLINE
RPM AVIATION OIL
STANDARD OIL COMPANY OF CALIFORNIA

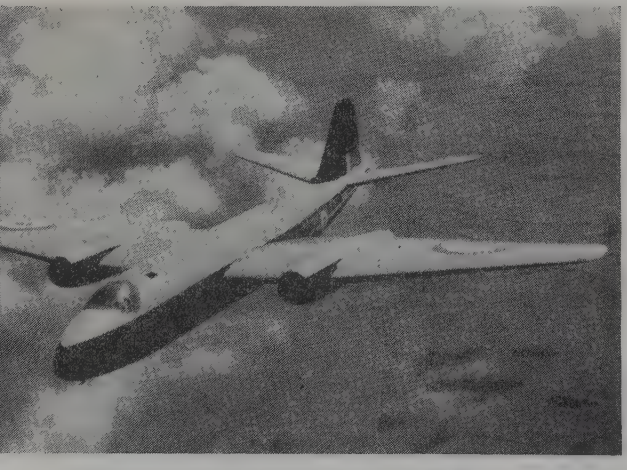
NATO air power

Current developments and progress report on air rearmament by NATO

By William Green

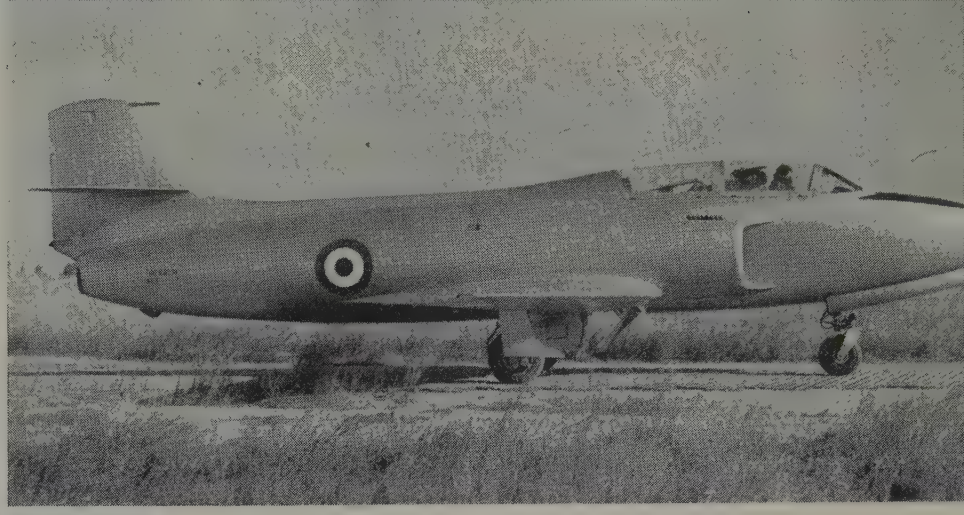


VICKERS VALIANT, British jet bomber *(above)*, is not expected to be available in quantity for the RAF until 1956-57. The *Canberra* B.2 *(below)* is now in service, 12 squadrons expected by late 1952



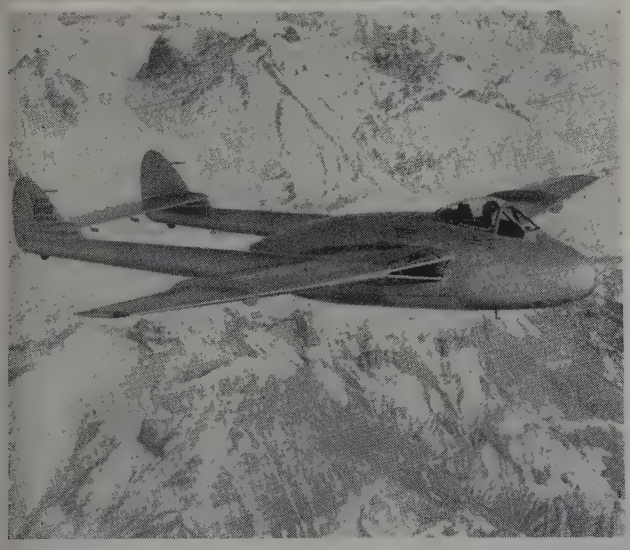
One of the most important points to arise out of the February-held Lisbon discussions of the North Atlantic Treaty countries was the decision to provide in Western Europe this year no fewer than 4,000 combat airplanes. The significance of this proposed aircraft strength becomes apparent only when one recalls that a bare two years ago the West European countries, who had disarmed materially and morally, possessed no single defense force worthy of mention. Even last year, when a series of NATO tactical air scrimmages took place under code-names such as "Pinnacle," "Ombrelle," "Cirrus," and others, a mere 1,000 airplanes—a large proportion of which were war-weary piston-engined machines that could be considered operationally first-line only *on paper*—could be mustered to participate in the largest of these air exercises.

NIGHT-FIGHTER squadrons of the RAF will be equipped with *Meteor* N.F. 11's *(below)* and *Vampire* N.F. 10's by the end of this year. These will be replaced eventually (1956) by de Havilland D.H. 110's and Gloster G.A. 5's



ITALIAN AIR FORCE will be equipped with Fiat G. 80B-2 jet trainers and single-seat all-weather fighters *(right)*. In meantime *Aeronautica Militaire* has *Vampires* and F-84E's

VAMPIRE 5's are presently being manufactured for Italian Air Force by Fiat, Macchi, Ambrosini and Alfa Romeo. Three Wings of *Aeronautica Militaire* are now flying *Vampires (below)*



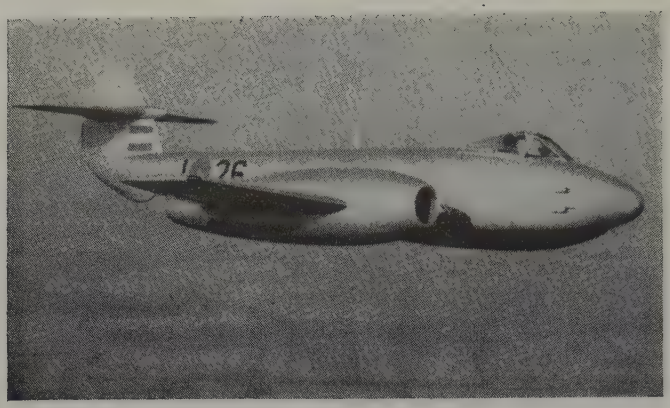
There is no indication of from whence the planners expect the remainder of the 4,000 combat airplanes to come; presumably a large number of them will be furnished by the U. S. under the Mutual Defense Assistance Program. But there are limitations to the amount of the burden that the U. S. airplane industry can bear, and the average American taxpayer, having agreed to put his hand in his pocket for a large contribution towards European defense, naturally wants an assurance that the costs of rearmament are being fairly distributed and that the West European countries are not just sitting back and allowing him to carry the baby for the whole trip.

The U. S. airplane industry cannot alone provide the planes, nor the USAF the personnel, for West European air defense, and if the NATO aim of averting aggression by means of strength is to be attained, the European NATO signatories have vital roles to play in the over-all program.

Rather than present readers with a forecast, optimistic or pessimistic, of the number of combat airplanes that the Allied Air Forces in Central Europe (AAFCE) could put into the air against the Russians should they strike tomorrow, next week or next year, and which would of necessity be misleading, in this progress report on European

FRANCE is moving into production of the *Mistral (above)*, a souped-up version of the *Vampire*. Later this year, the *Sea Venom* will go into production under U.K. license

DASSAULT MD 452 *(right)* soon will become France's standard day interceptor. S.N.C.A. du SudEst is building fuselages while S.N.C.A. du Sud-Ouest is building MD 452 *Mystere* wings



DUTCH AIR FORCE is nearing its target of 21 squadrons equipped with *Meteors (above)* and *Thunderjet* fighters

air rearmament, SKYWAYS proposes to review the current developments and programs of each European country contributing forces to the AAFCE; presenting an over-all picture of the backcloth against which the NATO air umbrella is being built up.

It has been agreed that the series of air exercises held over Western Europe during the past year were worth 10 years' of theoretical planning and pen-pushing. They revealed shortcomings in the existing radar chains, the limitations imposed by lack of adequately equipped airfields and ground facilities, weaknesses in communications systems, deficiencies in combat methods and the inadequacy of available equipment and forces. In short, they showed up the abysmal weaknesses in Western air cover as a whole, but they proved the efficacy of an integrated European military air organization, despite its language barriers and international jealousies.

As General Norstad, Commander-in-Chief of the Allied Air Forces in Central Europe, said recently; "If all goes well during an air exercise, there's something wrong," and plenty went wrong during these scrimmages. Nevertheless, they served their purpose of providing just the information from which an effective defense organization *can* be derived. They told the AAFCE what it had not got and what it needed, and they drew the broad lines of the defense patterns which are now falling into perspective.

An effective defense system is not merely a question of planes and men. It is as much a question of bases, supplies, and a coordinated industrial program. In the past many have considered that the three items required for the preparation for war, either defensive or aggressive, were money, money and yet more money, in that order. Taxpayers could not be blamed were they still to subscribe to this belief. It is true that money still plays a "star" role in modern armament, but it has now been joined at the head of the billing by a multiplicity of other demands and requirements; a fact underlined all too recently by the efforts of Western Europe to meet its commitments to NATO.

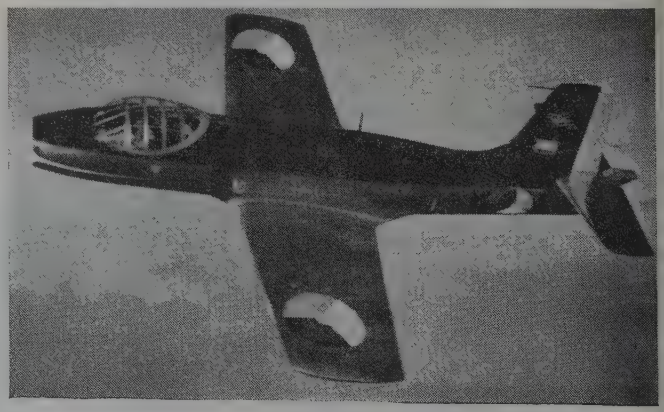
Far from coming at a time of economic depression, such as existed in the years preceding the last war, today's rearmament must be carried through at a period when there is no question of unemployment, idle plants and unused stocks of materials. The ability of West European countries to maintain international stability in the economic sphere and simultaneously maintaining the rearmament drive is no longer an academic question. It is now as serious a threat to European security as are Europe's present inadequate defenses. In addition to money, the questions of manpower, materials, plant space and equipment are causing concern.

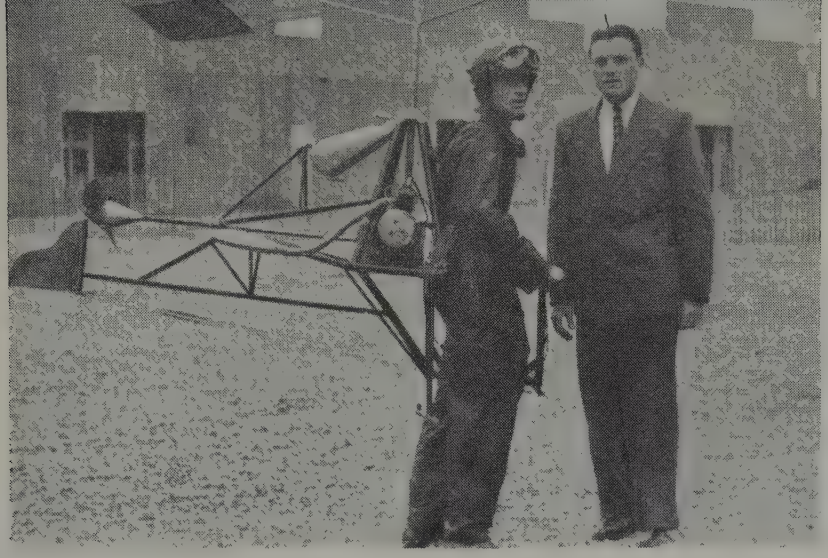
The plight of the British airplane industry is but one example of these difficulties: industrial bottlenecks, development delays, the inability to obtain sufficient quantities of strategic materials and a shortage of skilled labor have forced the slowing-down of the delivery program of new combat airplanes to the RAF. The labor force in the industry, which is now at about 177,000, must be increased by a further 50,000 by March next year if the present *reduced* program is to be carried through, and the industry must now compete for its personnel with the rapidly expanding RAF.

Great Britain

Britain, the major Western bastion in Europe, is making the largest single European contribution to NATO airpower and will furnish 1300 combat airplanes of the target figure of 4,000 to be reached by the end of the year. The RAF is making increasingly heavy demands on Britain's strictly limited resources. Her air estimates for 1952-53 are a net total of £138,890,000 ($388,892,000.00) up on the corresponding figure for 1951-52, and the current program provides for a (*Continued on page 38*)

HOLLAND'S first nationally designed jet is the Fokker S. 14. It is two-place trainer powered by Derwent 9





STRAP-ON 'COPTER was designed and built by J. Geslin, a bicycle manufacturer from Asnieres, France. Its test pilot was Raymond Haussteter *(left)*, shown here wearing test rig

Strap-On 'Copter

In the December issue of SKYWAYS a photo was published of an unusual one-man, strap-on-type 'copter built recently at Asnieres, France. We received numerous letters from readers; some amused, many skeptical, but all anxious for further details of this lightweight fly-about. Accordingly our European Correspondent tracked down this project and interviewed the designer, who was *not* Raymond Haussteter, as the photo caption had led us to believe, but was Monsieur J. Geslin, a 68-year-old bicycle manufacturer of Asnieres.

Monsieur Geslin told our correspondent that the idea behind his lightweight 'copter was to provide the smallest kind of flying machine that could lift a man and transport him; a cheap and simple "aerial motorcycle" costing little more to manufacture than its road-bound precursor. The machine illustrated in our December issue and in the accompanying photo is, in actual fact, little more than a test-rig, but work on the final drawings of the prototype is now well advanced and trials are expected to begin within a few months.

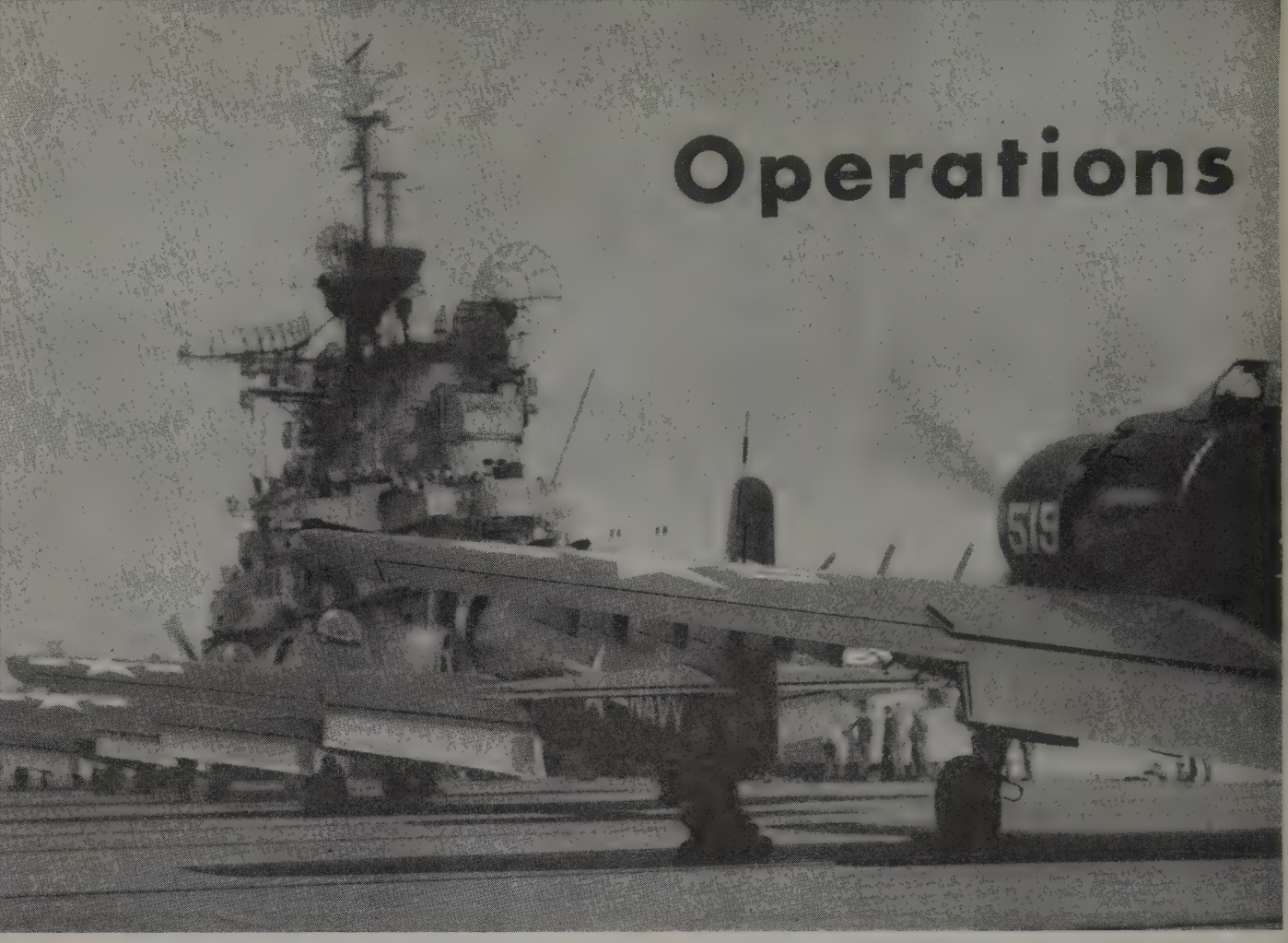
The test-rig for Geslin's "aerial motorcycle" was built to test various rotor forms, control systems and the feasibility of the basic layout of the 'copter. Built of light alloy tubing and employing a number of motorcycle components, the apparatus weighs little more than 40 pounds, although the prototype will probably weigh about twice that. The test-rig of the strap-on 'copter comprises a tube framework built on to a strong central column of four steel tubes and a base piece which serve as engine bearers and to hold the rotor drive column rigid. The forward part of the central column is strapped onto the back of the rider who sits astride a bicycle-type saddle. To provide drive for testing efficacy of the rotor system, a small two-cylinder motorcycle engine is mounted on the base of the central column and is gravity fed from a small tank mounted on the top of the rear framework.

The main rotor and the rear-positioned marine-type are shaft-driven from the two-cylinder engine through a series of gears. The diminutive rear fan is *expected* to provide a certain amount of forward propulsion and counteract torque by the flow deflection of a small rudder. The rudder surface is controlled by a horizontal bar, incorporating twist-grip throttle and gearchange, which connects up with two small-gauge cables, running between the rider's legs. There is no rotor head as such, both rotor spar and drive comprising a simple, braced, tubular-steel "T" held rigid by the central column. The rotor blades are articulated, that is, they change angle of attack as they spin to avoid a tendency to capsize, possess an angle of travel of up to some 45° and are simple, flat surfaces measuring about two-and-a-half feet by one foot. The two blades are mounted at the ends of the braced spar which has a span of some 10 feet.

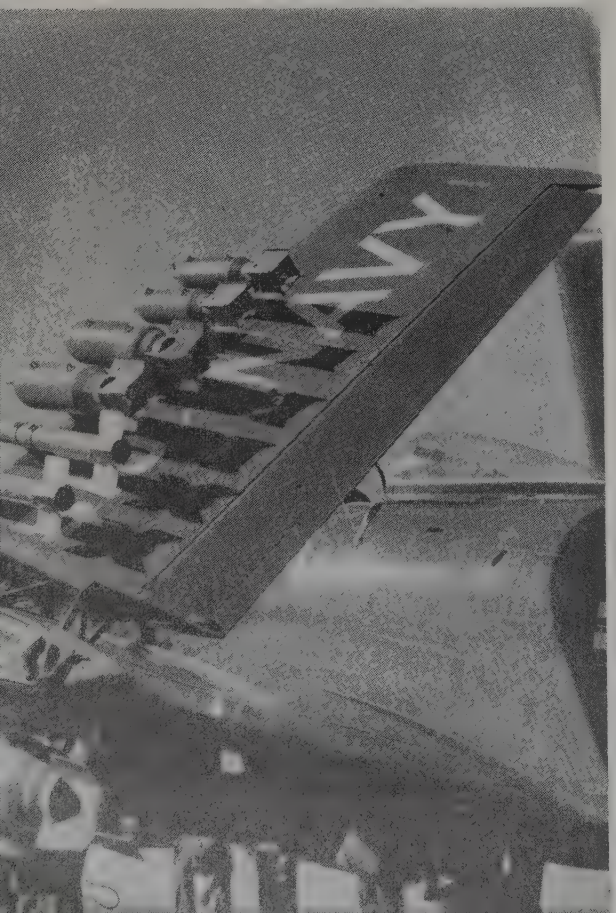
The prototype will be rather larger than the test-rig and the type of engine to be used has not yet been decided upon but may be a converted 26-hp *Volkswagen* air-cooled "flat-four," or a 25-hp. Poinsard. It is to be anticipated that the 'copter will possess some form of instrumentation, although it is logical to assume that this will be rudimentary and comprise only fuel gages and tachometer. Monsieur Geslin would divulge no details of the rate of rotation of the rotor blades, or the sort of performance he hopes to achieve with the prototype of his "aerial motorcycle."

In passing, our correspondent asked M. Geslin how Raymond Haussteter's name had come to be associated with the project, and was informed that M. Haussteter will undertake the test flying. When asked if M. Haussteter was an experienced 'copter pilot, his reply was "No, Haussteter has not yet learned to fly, but he will pick it up as flight testing progresses." (!!) *C'est Formidable.*

Operations



LOADED for the hunt and kill, the AD *Skyraider (below)* extends its folded wings skyward as it is prepared for another strike against North Korean Communists. AD's operate off *USS Princeton*



Flattop operations off Korea prove the prowess of both pilots and AD's

By Kate Holliday

It was pitch-black and the noise was deafening. Eight planes were warming up on the flight deck beneath the bridge of the *USS Princeton.* From where I stood, I could hear them but I could not see them. It was my first experience with pre-dawn take-offs from a big carrier. And it was a frightening business. It was also a vitally important one, for the planes were due to hit the Commies in less than an hour.

The *Princeton* was operating as one of the two carriers of Task Force 77 off the East Coast of Korea. Daily, her aircraft and those of the other carrier harassed the Reds unmercifully. And one reason why I am telling this tale is that what the Navy has done in the Korean War is a gallant saga, one which should be brought to the fore.

from a carrier

LSO on board the *USS Princeton* is Lt (jg) Mershon. The author, who sailed with the *Princeton* for more than two weeks, sits on the Landing Signal Officer's platform *(above)* watching day operations

CREWMEN of an AD-3W, early warning radar version of the *Skyraider*, climb aboard preparatory to mission over waters off North Korea. This version of the AD employs crew of three. Note its radar pod

It was a bit startling to the *Princeton* to have a woman aboard during combat operations. And I must admit I was a bit startled to be there, for I was the first female war correspondent to land and live aboard such a ship in such a spot. In fact, I was one of the few women in the Navy's history to remain overnight at sea—and I was luckier by far than my predecessors: I sailed with the *Princeton* for over two weeks.

That pitch-black morning, the phone had rung in my cabin below decks. Capt. William Gallery, the skipper, was on the line.

"Do you want to watch 'em take off in the dark?" he asked.

"Sure!" I answered sleepily.

I scrambled into my clothes, looked at my watch. It was 4 A.M. I climbed the ladders which had by then become familiar, and reached the bridge. It was blacked out except for a faint glow from the radar.

Radar is vitally important to fleet operations as you can imagine. At night the 15 or 20 ships of a combat task force steam in a zig-zag pattern, taking changes in course from the ship which carries the admiral in command. If someone zigs when he should zag, tragedy can occur in a matter of seconds. Thus, a constant watch is kept through the night hours on the "gizmo" which shows the position of every vessel.

Bill Gallery's eyes were more accustomed than mine to the dimness. He led me to his chair on the bridge and from somewhere produced a mug of the Navy's inevitable and incredibly good coffee.

"They'll go off in a minute now," he shouted over the din.

"What are they?" I shouted back.

"The AD's," he replied. "The 'all-weather' boys."

The AD's. There it was again. Pre-dawn take-offs are the toughest thing in Navy flying. And the AD was the plane the Navy chose for them. It was the ship they knew they could depend on.

Sitting there with the sound of 50 express trains in my ears, I thought back over the days that had just passed, and I realized suddenly that almost every time something really rough had been on the schedule, or every time something new had been tried or something really big accomplished, it had been done by a boy flying an AD.

And, because I had spent time with the other services, I had a point of comparison between the AD and the other ships I (*Continued on page 41*)

Salvage by Air

The helicopter, already firmly established as tops for flights to otherwise inaccessible areas, has scored again. Besides its value as a troop carrier and transporter of wounded men, the versatile whirlybird has now proved its worth again in the salvage by air of a Sikorsky HRS-1 helicopter from a Carolina mud flat.

Attached to Helicopter Transport Squadron 261 at the world's largest Marine Corps Air Station, Cherry Point, N. C., the helicopter developed engine trouble and crashed from a height of 150 feet. It was returning in a nine-plane formation from a troop-carrying maneuver at nearby Camp Lejeune and would have been over the Atlantic Ocean, a half-mile away, in another two minutes.

Capt S. J. Szycher tried to set his 'copter down on an island of high, dry land, but fell short and landed in the swampy mud flat where it could be reached by neither land nor water. The pilot and copilot perched on top of their airplane for an hour before they were rescued by a Navy Air-Sea Rescue helicopter. Neither was injured in the crash.

Although officers at the air station and John Cowan, Sikorsky's representative with the two helicopter squadrons at Cherry Point, knew of no previous salvage attempts on an aircraft in such an inaccessible area, they set to work on plans to recover the 'copter from its mucky resting place.

Using as their only guide the partial recovery by helicopter of a crashed aircraft in Korea, a crew of Marine mechanics planned the dismantling of the wreck and the flying out of the parts by other 'copters. The small island Captain Szycher had tried to reach was to prove of great value to the project as a base for operations.

The site was surveyed in advance by air and on the afternoon following the crash two helicopters from Squadron 261 flew to the island and landed. Copter "Six" was flown by Maj. Bob Neuss, an engineering officer who specializes in salvage projects, and "Twelve" was piloted by Capt. James Godbold. Aboard with two pilots were two other officers, Cowan, four helicopter mechanics, a radioman, a Marine photographer and the author.

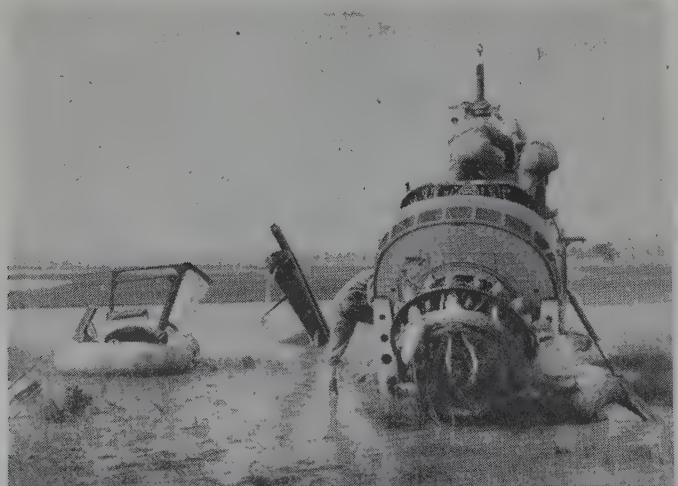
The difficulty of reaching the crash by more conventional means was evidenced by an amphibious tractor from Camp Lejeune. It had become stuck in the mud while trying to reach the wreck and there it remained throughout the afternoon.

Five members of the salvage crew donned rubber wading suits, inflated a seven-man rubber life raft, and waded with the raft across a narrow stretch of open water from the island to the swampy area where the 'copter had crashed.

There they found the downed aircraft in good shape except for the tail cone which on impact had snapped off midway back from the cabin and was stuck upright in the mud. At first it was thought the cone had whipped up and been stuck by the rotor blades, but examination showed that was not the case.

It was not long after the five Marines—M/Sgts George Comer and Brice Shadle, S/Sgts G. E. Higgins and T. L. Willis and Pfc E. K. Bogue—reached the wreck that they began calling to the island. They gave the sign of an arm rotated overhead to call for a 'copter to go aloft, and jumped up and down to show that the mud flat they were

WRECKED WHIRLYBIRD in mud and water, Marine mechanics work at dismantling. Note its tail cone stuck in mud



HELICOPTER pilot Capt. Reid follows directions of Lt. Rankin *(foreground)*, Sgt. Comer in landing near wreck

on was solid, although wet, despite the low tide.

The call to bring boards over was answered by Capt. Godbold, who hovered just above the swamp about 20 yards from the wreck while his load of "swamp boards" was shoved to the waiting men below. Lt. Jim Rankin, ignoring the pair of highly polished shoes he was wearing, dropped to the mud and directed the landing of the flying windmill on a wooden platform hastily built with the boards.

When the success of this maneuver was apparent to those on the island, Maj. Neuss took off for a flight to Camp Lejeune, six miles away, and brought back two loads of steel marsh mats. The mats, similar to those used for rapid construction of airstrips during the war, were built into a 'copter landing strip on the opposite side of the wreck from the captain's airplane.

The first concern of the salvage crew was for the three main rotor blades. Valued at $1,250 apiece, the slightest dent would mean ruin, so the men hesitated about carrying them across on a sling beneath a 'copter, and the cabins of the aircraft were too small to transport them. Instead, the men detached the blades and, balancing them on the life raft, waded through the mud to the solid land of the island.

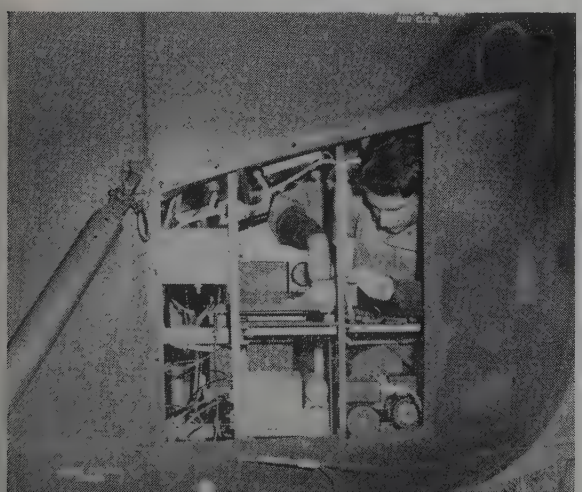
By then the major came in for a landing on the new strip. The landing worried Capt. Godbold, who was concerned over the danger of his ship losing its balance on the wooden platform, but a quick check showed the vibrations of the previous landing had caused no damage to the hastily built platform.

Meanwhile the crew was removing from the wreck all small accessories so the following day could be devoted to the major dismantling. Bogue, a radioman with the squadron, was busy inside the hull taking out the delicate radio apparatus while Capt. J. J. Riordan was in the cockpit removing all the valuable instruments. (*Continued on page 48*)

By Roy Johns, Jr.

TWELVE, with Maj. Neuss at controls, lifted the rotor head via hook and cable so neatly that it didn't strip a thread

RADIO equipment is retrieved from the wrecked helicopter by Pfc. E. K. Bogue



Twin TRI-PACER

Businessman-pilot adds engine to Tri-Pacer for increased performance, safety

By ROBERT HEGGE

On December 6, 1951 a strange looking aircraft roared down the runway of the Troh Skyport of Portland, Oregon and climbed into the somber sky. If we are to believe the aircraft engineers, the ship shouldn't have been in the air at all.

Harold A. Wagner of Portland had gone against all the rules of aviation design when he hooked two Piper *Cubs* together and brought forth one twin-fuselage plane mounted with twin motors. A small twin-engine plane is not new and planes with twin fuselages have been around for years, but a twin-engine ship with overlapping props is news.

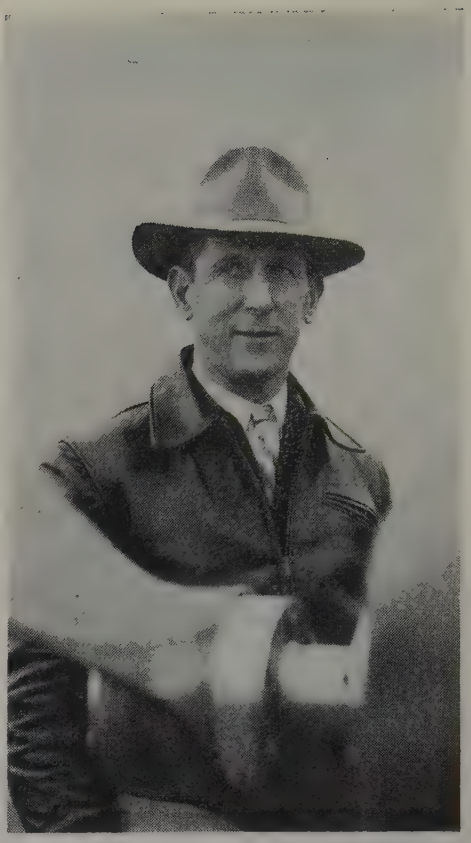
For years aviation men have claimed that in the case of overlapping props one prop would blank out the other. Wagner claimed otherwise. As the motors turn over and you face the ship, the prop on your right will be turning and the left blade will be coming down as the right-hand blade on the left prop will be coming up. Thus, according to Wagner, the blades do not create air disturbance. Only wind tunnel tests will prove him right or wrong. In the meantime the ship is flying and getting no end of stares.

Harold Wagner held to this twin-engine idea for years, but every time he brought up the subject his friends laughed it down. Finally Wagner built the plane —to prove his point as well as to satisfy his craving for a twin-engine airplane.

The first ship was built from two Piper *Cubs*—one a 1946 J-3 model with a 65-hp engine and the other a 1947 PA-11 with an 85-hp engine. The older ship mounted a wooden prop of 42-inch pitch while the newer job carried a metal prop of 45-inch pitch. In spite of this combination the test flight was a success.

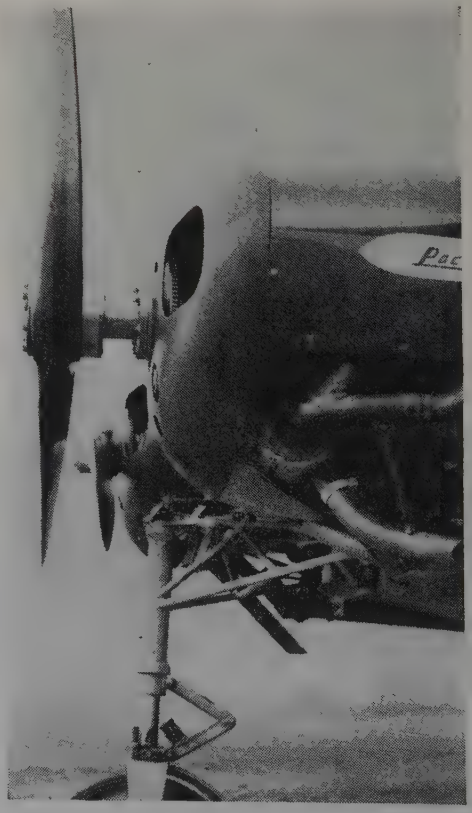
Under the direction of Wagner two men worked five days to hook the two planes together. Not knowing just what to expect, Wagner had the plane blocked up and ran both engines to check for vibration. In spite of the difference in the size of the engines and pitch of the props, the amount of vibration was very low.

To check controls and to get the feel of things, Wagner taxied the ship around the (*Continued on page 47*)



DESIGNER and builder of Twin *Tri-Pacer* is Portland tool manufacturer, Harold A. Wagner

SPOOL was added to one engine's crankshaft *(foreground below)* to allow prop clearance



ENGINES that power the Wagner *Pacer* are 125-hp Lycomings mounted 20 inches off center from thrust line and 11 inches to the rear. In production model cowling will be mounted to cover lower center unit as well as area behind engines. Single-engine *Tri-Pacer* cruises at 120 mph; Wagner's Twin at 135 mph

WAGNER-TWIN already has had 15 hours in the air. According to designer's estimates, total cost of Twin *Tri-Pacer* was under $9,000. Plane carries four, has top speed of 160 mph, 2,000-fpm rate of climb, burns 12 gallons per hour

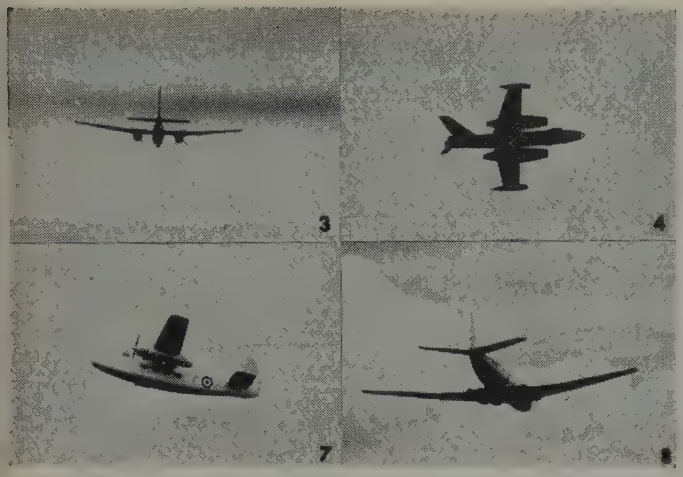
AIRCRAFT

REALIZING the importance of aircraft spotting in civilian defense, and in answer to innumerable requests for identification cues and three-views of current military aircraft, SKYWAYS brings to its readers a series of "ID lessons" on combat planes of the world. This, the first set in the series, includes the P4M-1, the P2V-5, the British *Canberra*, and the Russian Ilyushin.

The Martin P4M-1 *Mercator* and the Lockheed P2V-5 *Neptune* are land-based long-range Navy patrol bombers, both seen quite frequently over coastal areas, and the latter to be also seen over Great Britain, South Africa and Australia where it is in service with the respective air forces of those countries.

The P4M-1 appears to be a twin-engine airplane, and for recognition purposes can be considered as such. However, each engine nacelle accommodates both a Pratt & Whitney *Wasp Major* radial engine and a J-33 turbojet unit. An easy way to spot the *Mercator* is by its long nose section stretching out like the neck of a race horse at the winning post. The slim high-aspect ratio

CHECK your plane identification ability. Silhouettes *(left)* are P4M-1 *Mercator (top)* and P2V-5 *Neptune (below)*. Top-of-page photos are puzzlers: Number 1 is RAF *Canberra;* 2 is Lockheed XF-90; 5 is P4M *Mercator;* and 6 is Yak 15B

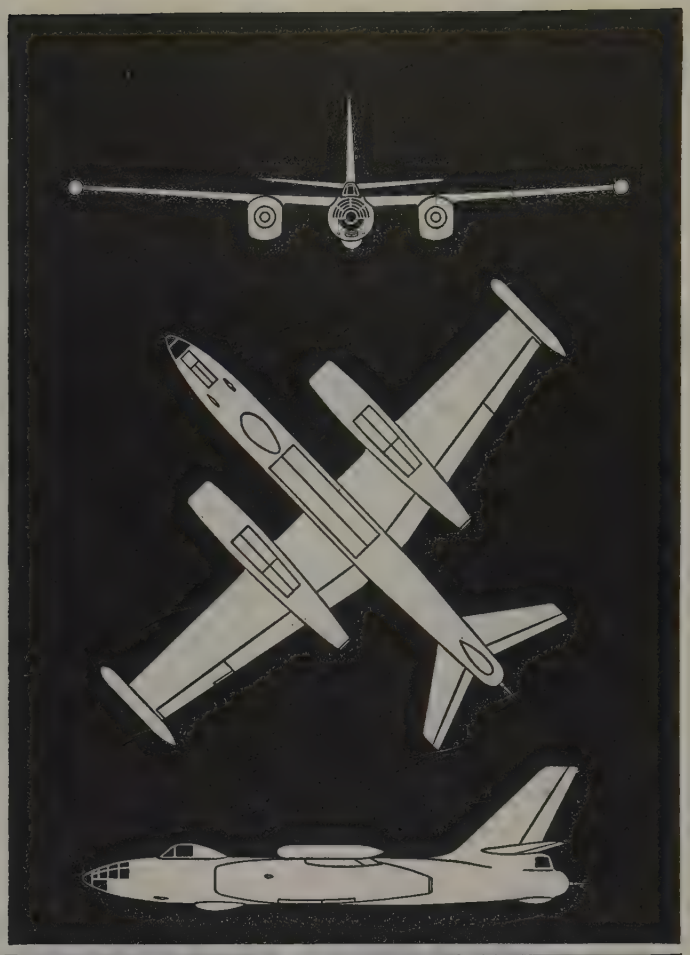


Identification

wing (which spans only four feet less than the four-engined B-24) has only a slight taper on the leading edge but tapers sharply on the trailing edge which is unbroken by the rear sections of the engine nacelles. The fuselage of the P4M-1 embodies a very prominent cabin hood which, together with two radomes and a mid-upper turret, break up the sleek fuselage contours. The tail assembly is insignificant in appearance, not offering any prominent recognition features, and has blunt, rounded contours.

Data. Span: 114 feet; length: 86 feet 2 inches. Power: two Pratt & Whitney R-4360-20 radials and two Allison J-33A-10 turbojets. Armament: two 20-mm guns in nose, two 20-mm guns in tail turret, and two guns in dorsal turret.

The P2V-5 *Neptune* has a much shorter nose than the *Mercator*. This gives the fuselage a deeper and less rakish appearance. The fuselage is surmounted by a disproportionately large vertical tail surface which makes an excellent identification feature in a side view. Another aid to "ID" is the *Neptune's* usually large under-belly radome. The wings trailing (*Continued on page 46*)



PLANE I. Q. will show up here. Silhouettes *(right)* are Russia's twin-jet *ILyushin (top)* and British *Canberra (below)*. Top-of-the-page photos are: Number 3, Lockheed P2V-2 *Neptune;* 4, *ILyushin;* Number 7, British Percival *Sea Prince;* and 8, *Comet*

MANAGER WILLARD *(left)* meets his aerial-commuting boss, Soderstrom *(standing on wing)*, at the Brawley airport

Businessman's Bonanza

With three businesses to operate, key to this man's success is his Bonanza

By Wesley Neal

CHUCK SODERSTROM is a 35-year-old Southern California business man whose expanding commercial interests range from a San Pedro automobile agency to butane and bottled water plants in the California-Arizona-Mexico triangle. A husky, six-foot, soft-spoken ex-U.C.L.A. football player, Chuck carries on his many-sided activities from two points of control: his San Pedro office and the cabin of his Beechcraft *Bonanza.*

With main headquarters in the ocean-side town, Chuck commutes weekly to the arid Coachella-Imperial Valley region where he supervises the butane gas and drinking water operations he owns there.

At Torrance Municipal Airport, just next-door to San Pedro, Chuck has a small, *Bonanza*-size, private hangar equipped with tools, wiping rags, etc. Before each flight, he checks his own oil supply, examines the engine and surveys the general airplane condition, performing the latter feat while running over the ship with a wiping cloth. Now two years old and logging 650 hours, the trim red job looks factory-new.

A pilot since 1939, Chuck did his air-commuting in a surplus BT-13 prior to acquiring the *Bonanza.* After comparing initial cost, maintenance, operation and suitability to his own needs of several makes, Chuck settled on the *Bonanza.* A careful boy with the pencil and paper, Soderstrom has kept accurate figures on all phases of his flying activities. "I'm convinced," he says, "that the *Bonanza* flies farthest, fastest and cheapest with the biggest payload

of any similar airplane on the market today."

Chuck telephoned his flight plan to Long Beach Airways Communication Station and we were off at 7:45 A.M. Following through from the right seat, I liked especially the vernier control on the throttle. The steady, screw-action which advances or retards the throttle, protects the engine and makes for smooth power changes.

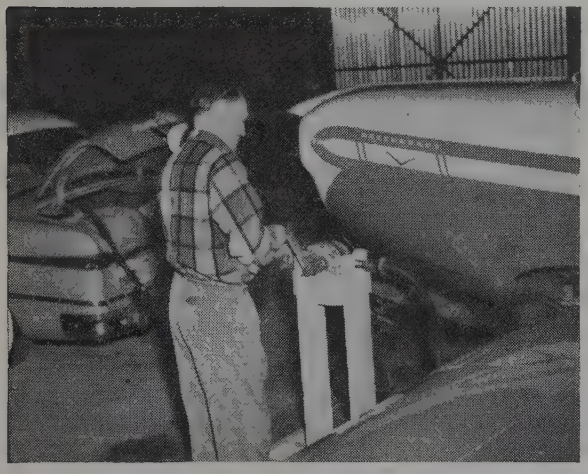
It was one of those rare, clear Southern California mornings when the entire coastal plain from the Tehachapis to the Santa Ana Mountains stretches before the eye in sharp relief. Chuck climbed on course, heading due East for the Beaumont-Banning pass between the two-mile high San Jacinto and San Gorgonio peaks, snow-capped and shining in the morning sun. Using a cruising climb, he maintained a steady 120 mph Indicated. Cabin noise was at a minimum and talk—shop, small or otherwise—was perfectly possible in a normal tone of voice. For every direction except straight back, visibility is unobstructed in a *Bonanza* and the terrain jumps at you, pretty as the view from a picture window.

When he reached the ridge, Chuck began a gradual let-down toward our destination at Indio. Here the floor of the valley slopes at the same approximate rate as our speed of descent. In this way, Chuck managed a constant 1,500 to 2,000 feet above the ground, beneath which minimum he will not fly. A careful pilot with no time for "hot-rock" techniques, Chuck keeps the odds stacked on his side by calculating every possible hazard. Except for such occasions as his record, non-stop solo trip to New York and return, he does not fly at night. Neither will he overload the plane nor vary the load from his center of gravity limits. His particular airplane would delight an old man's heart with its bevy of safety devices: VHF and LF radio, Omni, ADF, stall warning indicator and automatic cover for the pitot tube. This old man was especially intrigued by the last—a small, metal tab which falls into place by gravity when the ship is parked on the ground. Upon moving through the air, the slipstream flows against an arm which uncovers the pitot tube.

Death Valley Scotty, Peg-leg Pete and sundry other ancient and hardy characters have given to the desert spots of America rather frightening reputations. But that was before water. Since the coming of the All-American canal, the once-desolate Coachella-Imperial region is literally blooming as the rose. Hundreds of oasis-like ranch homes cover the valley floor. We passed Palm Springs, the Shadow Mountain Club and private and public dwellings which, even from the air, speak of luxury and comfort. Warm the winter-round, smog-free, mellow in January and glittering in the sun, it was hard to believe that we were but 30 air-minutes from ocean fog and dampness. Chuck pointed to our destination and jerked his head back toward our point of departure. "This trip was murder when I used to make it by car," he said. "Took me a full two days for the round trip and I had to drive like mad. Besides, the highway's getting too dangerous, what with all this traffic." We were 50 minutes out of Torrance and he began the let-down to traffic-pattern altitude for a landing at Thermal, the airport which serves Indio.

Thermal has no tower control and Chuck called Thermal Radio to close our flight plan. Having made the once-a-week trip by air for six years now, Chuck and the boys in the Thermal CAA facility are on good terms, as I was to observe momentarily.

No sooner had we taxied up to the hanger at Thermal than Jeff Baker, manager of Chuck's Indio Gas Co., drove up to meet us. I couldn't help but admire the timing and said as much. Jeff smiled. "As soon as Chuck radios his arrival," he said, "the operator in the (*Continued on page 57*)



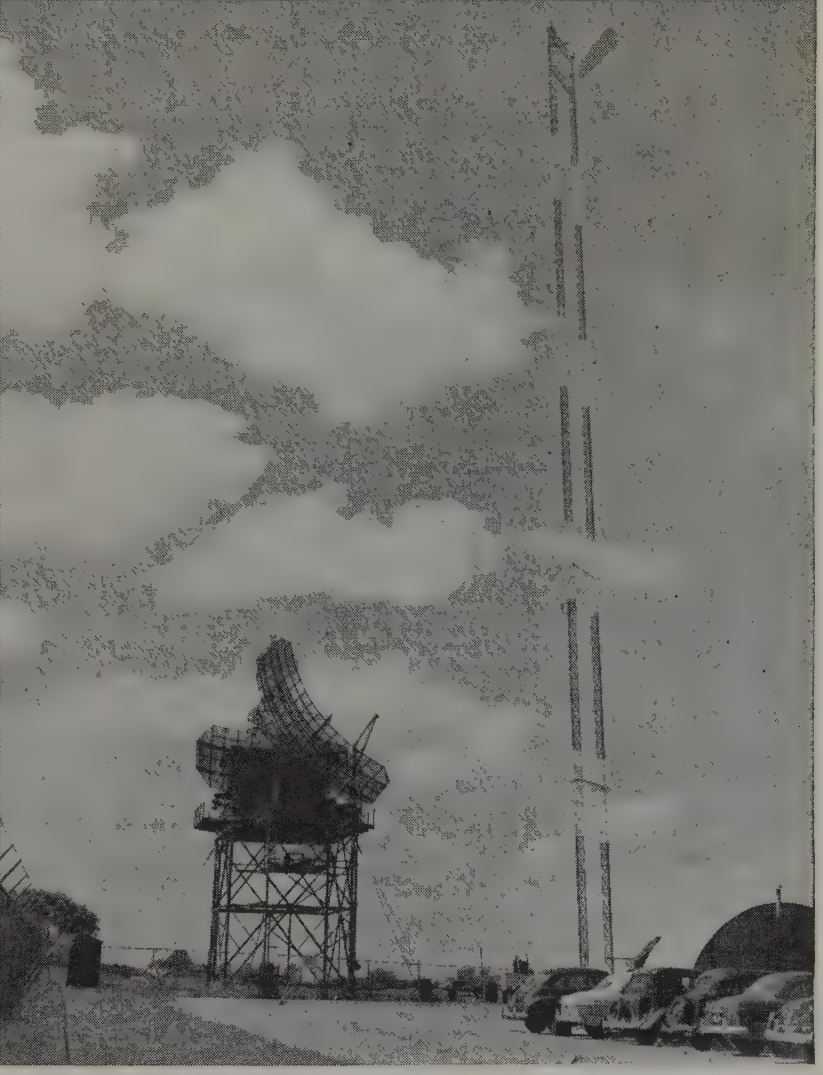
EXTRA TANK in car holds aviation fuel. Using homemade pump, Soderstrom fills *Bonanza's* tanks after flight

PILOT TUBE has hinged cover held into place by gravity during ground operation; slipstream uncovers it in flight

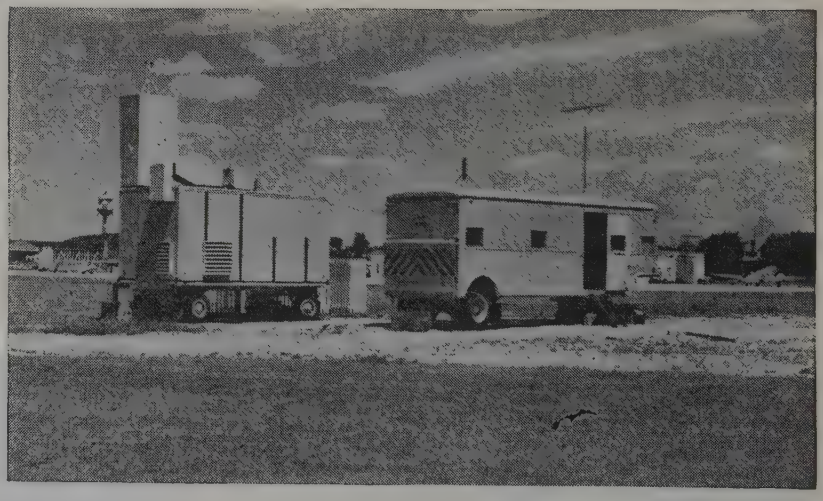
GCA *or* ILS?

How well do GCA and ILS work . . . which is best, according to pilots

By Douglas J. Ingells



TOWER *(above right)* is radar antenna for long-range interception at a distance from runway. Tower (background) contains micro-wave equipment to send signal to a short-range radar set located near the end of the runway



GCA MOBILE unit houses Ground Control Approach equipment, is located at end of runway in use. Controller picks up plane when it is six to eight miles away from end of runway, talks pilot down until he breaks out over the runway

One day back in the fall of 1929 at Mitchel Field, Long Island, Jimmy Doolittle, then an Army Air Corps lieutenant, climbed into the cockpit of an old Consolidated two-seater biplane. He then proceeded to demonstrate to the world that a good pilot could fly even if he couldn't see.

A special canvas hood was constructed over the cockpit so that the pilot was completely in the dark —except for the instruments on the panel in front of him. These consisted of a new attitude indicator, a new directional gyro and a sensitive barometric altimeter so delicate as to measure the height of the plane to within a few feet of the ground. With these as his "eyes" Doolittle took-off, flew the plane around a pre-determined course, landed and parked it at almost the exact spot where the flight started.

The test was part of the Guggenheim Foundation's experiments in fog-flying. It marked the first

successful "blind flight." A new flight era was born.

Today, scientific progress has made many improvements in the instruments. But the problem of fog-flying is still there. In truth it has grown in magnitude; not because there is more fog, but because traffic in our skylanes has jammed up the issue. Bad weather, especially fog, is the greatest single hazard to aviation. Toughest bugaboo of all is getting planes down to earth at airport terminals when the fields are blanketed with grey cloaks of fog or mist.

Recent tragedies, such as the trio of accidents at Elizabeth, New Jersey which temporarily closed the Newark Airport, indicate that the problem is still with us. Although prime cause of these mishaps is believed to be aircraft malfunctions, bad weather could have been a contributing factor. When pilots can't see much beyond the noses of their planes, there is danger, not only to those in the planes but to residents on the ground. Our populace doesn't want death from the sky in the form of "lost airliners" crashing into its sleep or domesticity. Aviation's greatest challenge is to provide blind landing systems that will eliminate such a threat.

That man Doolittle is again right in the midst of the problem. A retired Air Force General of Tokyo-raid fame, he has been on a special assignment for the President of the United States to investigate conditions at America's airports. One factor on which he is certain to turn the spot light is the provision at our flying fields for blind landing systems. There are two systems commonly in use: (1) ILS—instrument landing system installed at virtually all terminals; (2) GCA—Ground Control Approach (Radar) installed at only a few major commercial points, although most military installations are equipped.

The big questions are—How well do these systems work? What's being done to perfect them and improve them? Which is best?

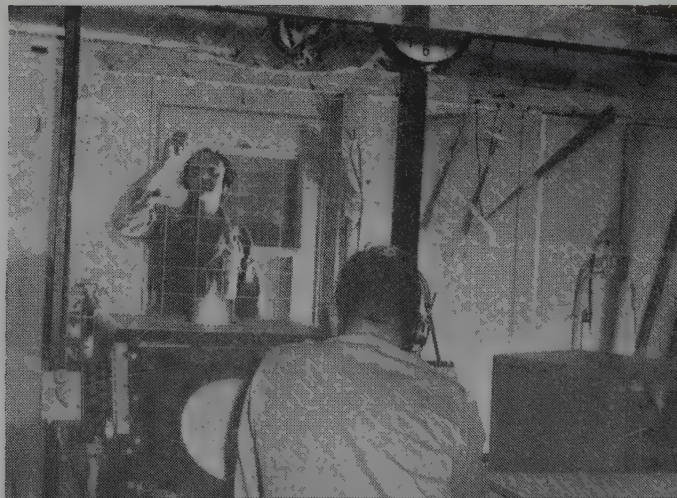
The difference between the two systems is the difference between radio and television. ILS uses radio signals and beams to allow a pilot to guide himself out of the fog and down to the runway. GCA uses radar which visually pinpoints the plane's location to a ground controller working the radarscope and lets him direct the pilot into the proper approach pattern. Both systems attempt to do the same thing—give directions to a blind pilot so he can jockey his plane into position on a proper localizer and glidepath that will bring him safely to earth.

Both GCA and ILS incorporate special radar or radio appartus installed along an airport's instrument runway. (This is usually the heavy-duty runway which parallels the prevailing wind direction at a given field.) In the ILS the radio sends out beam signals, invisible "lines" which establish the direction a plane should be flying and which indicate the proper glide angle to the runway.

One needle on a cross-pointer indicator on the instrument panel tells the (*Continued on page 54*)

OPERATORS working the long-range surveillance radar check incoming planes while they are still miles from the base, locate their positions on the transparent chart *(background)* and get them into line for quick landings

OPERATOR working on short-range radar "takes over" when plane is within 10 miles of base. Aircraft's approach is controlled from here until plane is headed onto runway when GCA takes over for the bad-weather touchdown



MECHANIC installs ground ventilation blower in the DC-3 heater vent

summerize your DC-3

A few modifications for summer flying will keep aircraft efficiency up and the executive passengers much cooler and happier

By CHARLES KNOX

Project Engineer, AiResearch

Any good executive airplane today should be an all-weather transport. When an executive plane may go from the Arctic Circle to the Canal Zone in one trip, the aircraft must be equipped to handle all the changes of weather of the seasons.

As the summer temperature rises, there are a few simple modifications that one can make to keep aircraft efficiency up and the passengers happy.

The biggest single aid to really hot weather flying is the addition of a 600-cubic-foot-per-minute blower on the ventilation side of the cabin heater on a DC-3. A toggle-switch in the cockpit operates this unit on the ground to keep air circulating in the cabin.

A white-topped paint job, now used by virtually all the airlines, will keep the inside temperature down as much as 10° to 15°. When a customer plans his paint job, we always recommend a white or near-white top. It is surprisingly easy to blend the light paint atop the fuselage into almost any company design.

What about de-icer boots in the summer? General practice, until a few years ago, was to remove the boots when the temperature began to rise, and put them back in the winter. This operation takes about 200 man-hours per transfer when it is done properly and the holes are filled with flush screws. There is always the risk of puncture to the boots in removal, plus the very definite problem of adequate storage. Now we recommend that the boots remain on the aircraft at all times, not only because it is cheaper but today's executive planes are really all-weather transports and may very easily encounter icing conditions on flights to Canada and Alaska that would require boots even in the summer months.

When the boots remain on the airplane, they should be wiped off with glycerine every 100 hours to remove oil and assure that the rubber does not deteriorate.

A CAA bulletin (Note 3-A-618, Aircraft Specifications, Dec. 10, 1951) permits the legal take-off weight of an extra 146 pounds on a DC-3 if the boots are installed. This represents roughly the weight of the de-icer boots and makes the all-up gross 25,146 pounds. The thinking behind this

added weight waiver is that the CAA does not want to penalize the operator for having safety equipment installed.

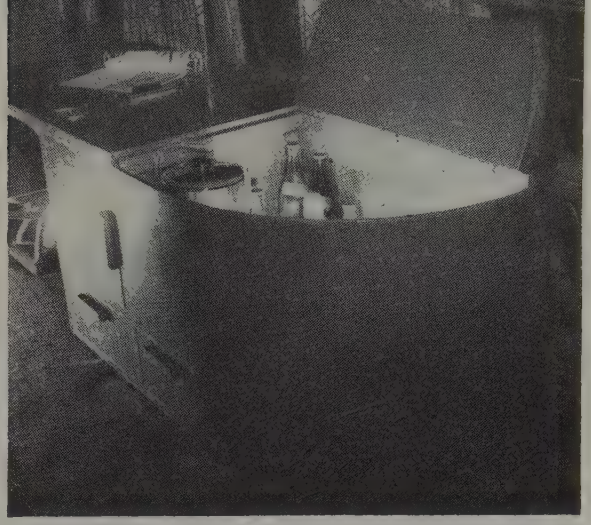
We recommend that our customers carry at least 10 gallons of alcohol for their propeller anti-icer units at all times. Our own DC-3 conversions have a single 20-gallon alcohol tank mounted behind the copilot's seat.

There is one under-the-cowling short-cut that some mechanics use when the weather is hot. By setting the carburetors a little on the rich side, they are able to keep the cylinder heads running cooler in hot weather. However, the fuel consumption goes up at the same time.

In the past years both engine oil and hydraulic fluid were changed with the seasons, but not any more. We use the same hydraulic fluid—#3580—and the same #1120 SAE 60 oil all year round.

While none of our executive customers has yet asked for it, Spartan in Dallas is working on the pilot model of an air conditioning unit for DC-3's. The air conditioning system that our parent company, AiResearch Manufacturing, makes for jet fighters is not suited for executive use because of the extensive conversion that would be necessary to adapt it to the larger, slower flying DC-3.

A very logical step for hot weather airports like Phoenix, Arizona, is to have ground air conditioners available for executive planes just as they do for scheduled airliners. In this way the cost of ground cooling could go right on your bill for gasoline, hangar rent and landing fee, if any.



HOT-WEATHER AID for the executive transport is an ice compartment for cooling beverages, as this one in a DC-3

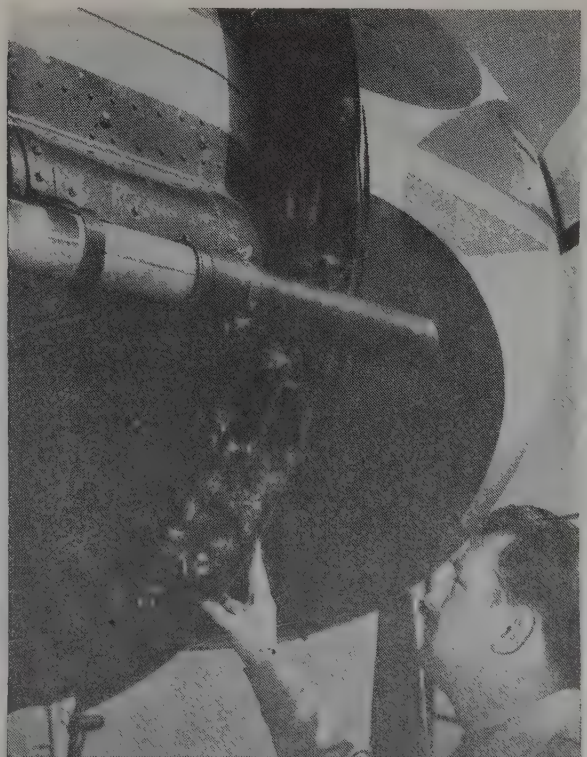
Small items such as seat covers are greatly affected by cold and heat. If the aircraft is to be used extensively in hot climates, we recommend nylon covers. Wool and the usual "plush" covers are fine for cold weather, but they add to passenger discomfort in very hot weather.

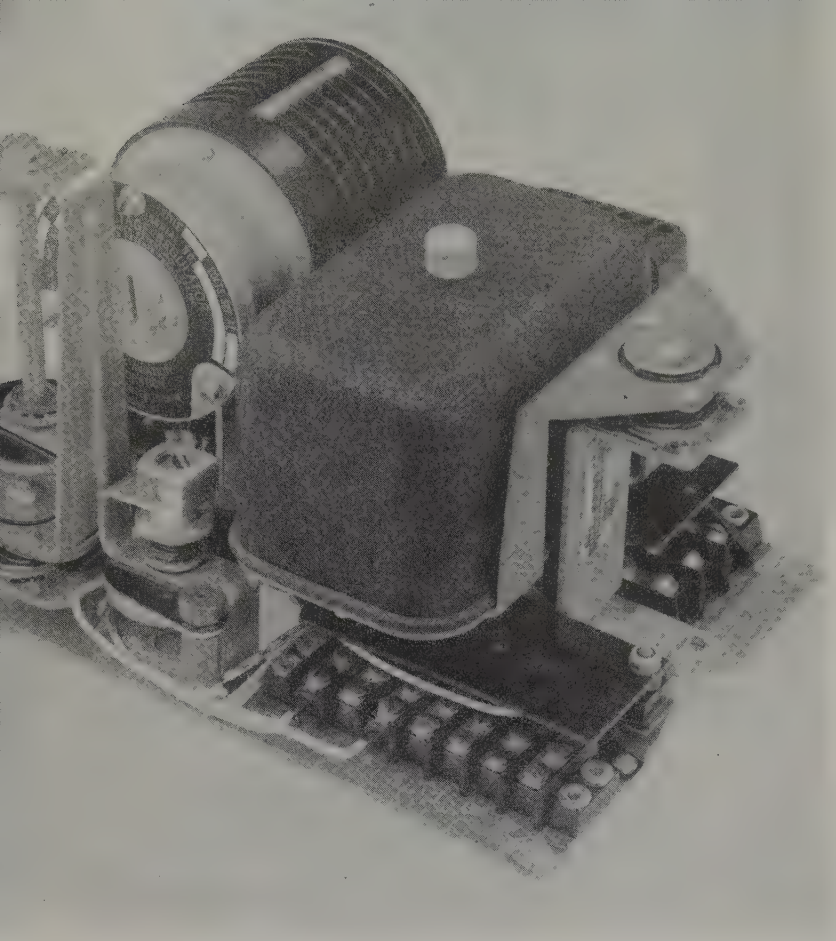
A good job of soundproofing the cabin improves insulation and will ward off heat on the ground for a considerable time. Mica or "dum-dum" and three inches or more of Fiberglas will make a cabin not only quiet in flight but also relatively well insulated against heat while the plane is parked on the ground.

One of the best hot- (*Continued on page 49*)

GROUND BLOWER to help keep executive transport's cabin cool when on the ground is installed in tail compartment

COWL FLAPS should be carefully checked and they should be kept open for taxi. Head temperatures must be watched





VOLTAGE REGULATOR shown here is Eclipse-Pioneer 1539 Control Panel. Mounting base assembly is bolted directly to aircraft structure

Automatic

Carbon pile voltage regulator supports function of aircraft generator, and is one of the most important units

By R. P. Mosley and H. J. Pyle

In the May issue we discussed the generation of direct current for use in our present-day aircraft and referred to the generator as the heart of the electrical system. The generator, like the heart, must have many important units supporting its function. The most important of these is the automatic voltage regulator, or, as it is known today, the carbon pile voltage regulator.

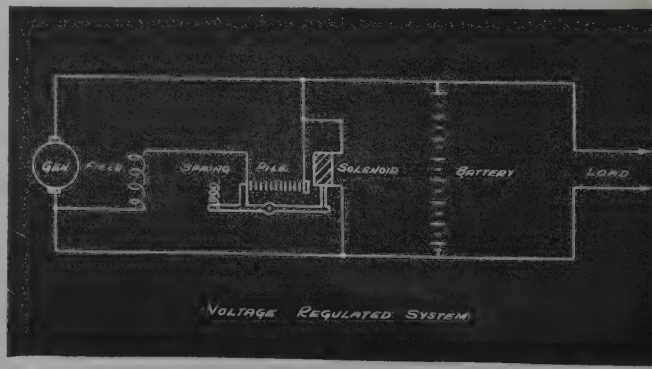
The purpose of the automatic voltage regulator is to maintain an approximately constant supply of d-c electrical energy flowing through the arteries of the aircraft, despite variations in generator speed or applied loads.

The early day electrical requirements of aircraft were satisfied by 12-volt systems which were fed by 15, 25, 50 and, in some cases, 75-ampere generators. But, it was during this period of operation that accessories and instruments were devised, for the safety and comfort of the passenger and crews, that required a constant voltage for satisfactory and safe operation. The use of these units, requiring constant voltage, made it necessary for the aircraft industry to develop an automatically controlled electrical system suitable for use in airplanes.

The devising of a competent aircraft electrical system became a challenge to the engineering fathers of our present-day complex giants of the sky. The only automatic voltage regulators in existence were the cumbersome industrial automatic regulators used in stationary installations. To develop a voltage regulator which would fulfill the requirements of the aircraft industry, by giving satisfactory performance under all conditions found in flight operations, became the goal of every aircraft accessory manufacturer.

The size and weight of the unit were not the only

FIGURE 1—This schematic is of a carbon pile regulator, typical of the units used in today's aircraft electrical systems



Voltage Regulations

factors to be considered in the evolution of the automatic voltage regulator. Minimum radio interference, resistance to transient vibrations and operations during wide ranges in temperature variations were component characteristics requiring engineering refinement.

Other problems were encountered in the generators to be used. Generators, at this time, were in the development stage necessitating the checking of the calculated generator characteristics and the changing of the design to make them suitable for operation in a regulated system. At first the design called for the use of two field circuits, one for the generator and the other for the regulator. The total field current was limited to 12.5 amperes but final specifications called for a field current to eight amperes and the regulator to use one circuit. The regulator was to vary the field resistance from 0.25 to 75 ohms in steps that would not produce surges greater than three volts at the generator terminals.

The history of automatic voltage regulation in aircraft can be traced primarily through the design and evolution of four types of automatic regulator.

1. The Tirrill Regulator
2. The GDD (General Electric) Regulator
3. Multiple-Contact Regulator
4. The Carbon Pile Regulator

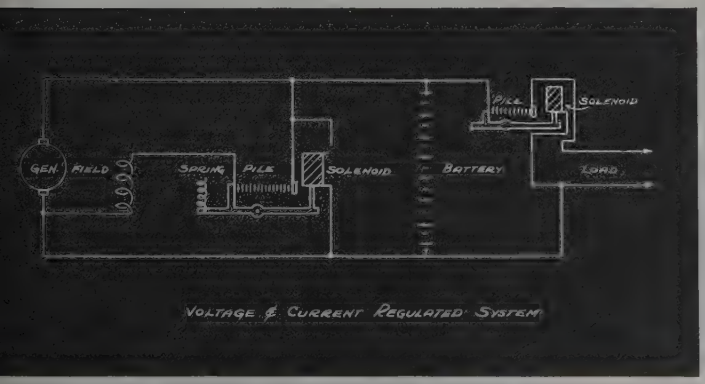
Although many other types and designs of regulators were experimented with, these four were the most prominent and most accepted of all.

1. The Tirrill Regulator was one of the first regulators in which the voltage was controlled by small relay contacts which short circuited the shunt-field rheostat. The duration of the short circuit depended on the amount of regulation required. The field rheostat was usually set so that the generator voltage was approximately 35 per cent below normal when the regulator was disconnected.

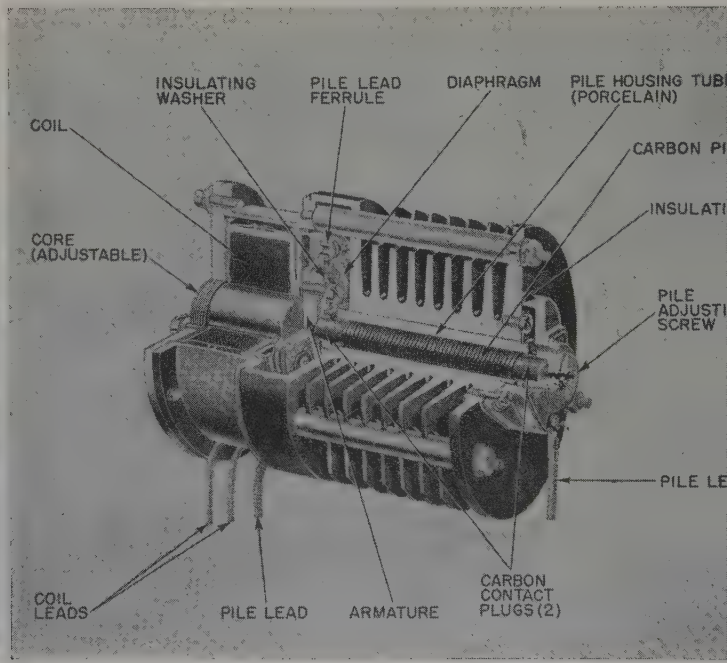
This regulator had a U-shaped magnet with two solenoids differentially wound upon its core. One winding was connected directly across the line and the other connected across the line through the main contacts. The main contacts intermittently short-circuited the generator field rheostat.

The main contacts were held closed by spring tension. The control magnet opened and closed the main contacts as the voltage increased or decreased. If the voltage (*Continued on page 44*)

FIGURE 2—This carbon pile voltage regulator uses diaphragm-type armature, not British-developed Newton armature



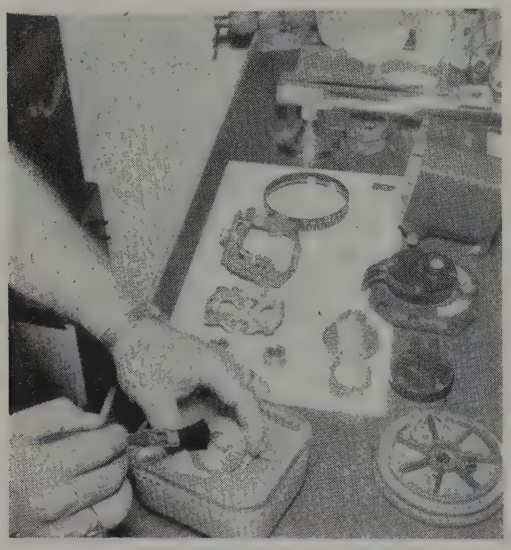
CUTAWAY of Eclipse-Pioneer 1539 regulator shows components of the control panel assembly that is mounted on the base assembly. It has carbon pile voltage regulator (Fig. 2)



1. A directional gyro should be bench-checked every 100 hours; overhauled every 300 hours. First step in overhaul is disassembly of gyro

GYRO overhaul

The directional gyro is an important instrument that requires care and periodic overhaul

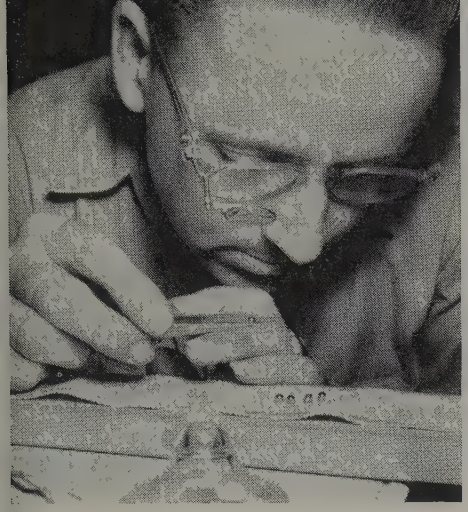


2. Before being lapped, gyro rotor assembly is cleaned. Here, a special brass cleaner is used, after which the rotor will be rinsed in benzine

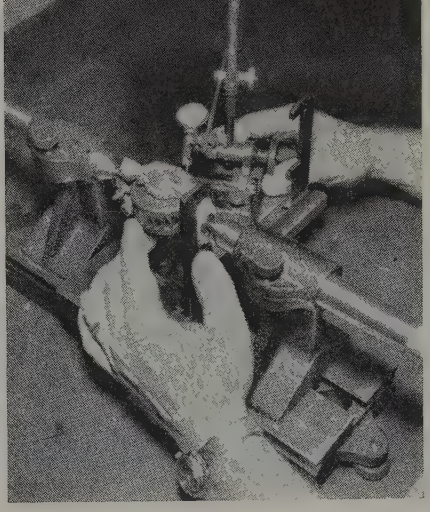
WITH directional gyros difficult to get and expensive to replace, owners and pilots are eager to give careful treatment to the DG to prolong its life. With that in mind, Southwest Airmotive offers these seven recommendations: 1) To make sure component parts, particularly bearings, aren't worn beyond repair, the DG should be bench-checked every 100 hours; overhauled every 300. Bench-checking usually costs about $4.00. 2) Overhaul the DG every 300 hours because at about that time the oil begins to disappear and rotor bearings start burning out. 3) If you have a spare DG, interchange it with the one in the plane every 100 hours. The oil on the bearings begins drying up if the unit is stored for long periods of time. 4) If a DG hasn't been used for more than three months,

3. High-speed motor is used to lap bearing races. Equipment includes (*left to right*) Scorsby for gyro calibration, gyro horizon, still-checker

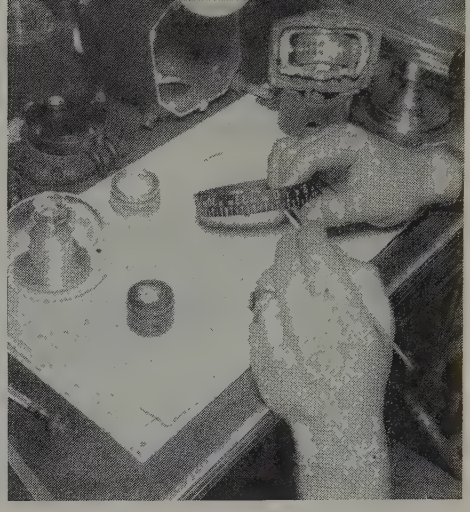
4. Technician at Southwest Airmotive uses a sensitive drill press to recondition and lap the rotor pivots of directional gyro



5. After races have been cleaned and lapped, balls are polished, inspected through "eye loupe"



6. Using universal balance and an indicator, rotor is assembled, then centralized to 1,000th inch

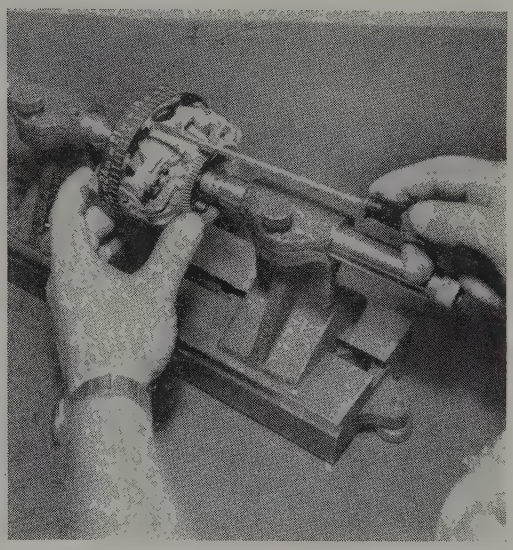


7. After rotor has been assembled in the vertical ring, a gyro technician uses radium paint to retouch the gyro's dial

it should be disassembled, cleaned and relubricated before going into service. 5) Vacuum should be kept at 4 inches of mercury. If it is higher, rotors turn too fast, cause wear; if slow moving, rotor tends to cause drift. 6) Fly with DG set on your compass heading. Flying with it set on Zero causes gear assembly on bottom of vertical ring to become worn. It must then be replaced. 7) Insist that only factory-new parts be used in overhaul.

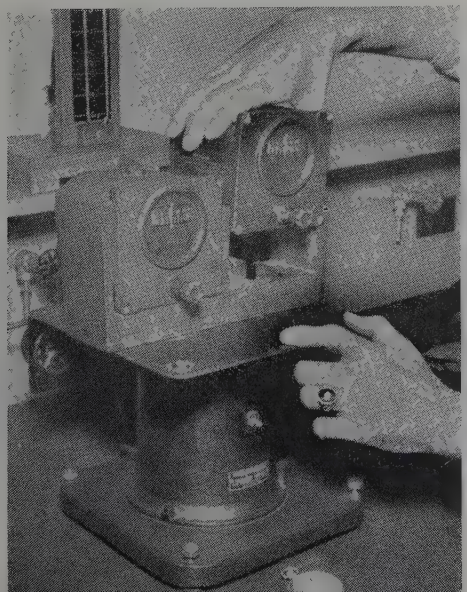
As a "curiosity," SAC instrumentmen pass on the report that tobacco smoke over a period of time is sucked into DG's, forming plainly visible nicotine rings around air pivots and rotors and gumming up air nozzles, decidedly shortening the gyro's life.

The photos illustrate the technique and equipment used to overhaul gyros.

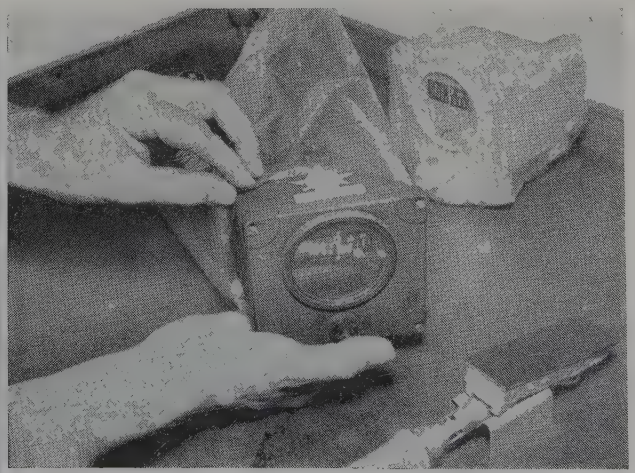


8 With the directional gyro's dial retouched, the assembled rotor is then placed in the universal fixture for precision balancing in all positions

9. After final assembly in the case, the gyro is tested on the Scorsby, undergoing simulated flight conditions; final calibrations are made



10. Overhaul, calibration and case repainting completed, the gyro is then placed in a cellophane bag to be sealed for shipment to customer



TWIN-BEECH, owned and operated by Brown-Graves Co., is based at Akron, Ohio. Chief Pilot is Lee Balestra; copilot is Donald Miller. Guest passengers are given a souvenir booklet

SKYWAYS for BUSINESS

News notes of pilots, plane owners operating aircraft in the interest of business

"Jet-Cooled" Power Package Being Readied for Use With Ryan Navions

A 225-hp "jet-cooled" power package is now being licensed for *Navions*. The new installation uses an exhaust augmenter to pull heat away from the engine, enabling more power to be drawn from the powerplant. Originally designed for the Fletcher FD-25, this Continental engine cooling arrangement proved so successful that Fletcher Aviation Corp., of Pasadena, Calif., made a similar unit for its executive *Navion*. Designer John Thorp reported a conservative gain of 15 mph in top speed with no cooling problems encountered in full throttle, low-speed climbs.

Commenting on this development, John Thorp said, "There is a 400-mph wind going through the engine with full power at maximum speed. The six-inch stainless steel augmenter tubes installed on the end of the exhaust system cause a pressure drop forward of the firewall that is greater than that caused by ram-air alone. We can run this new 'jet-cooled' engine full throttle on the ground indefinitely without overheating."

Cool air is drawn into the engine from the top of the cowling, kept away from the hot exhaust system, and sucked out the augmenter tubes by the force of the exhaust gases. This system is similar to that used on the Convair 240 and the *Twin-Bonanza*. The E-225-8 Continental is similar in size to the original E-185 powerplant. The added horsepower is obtained by improving timing of the cam shaft and efficient cooling. The "Fletcherized" jet-cooled system will be available for 185-hp and 205-hp *Navions* also. This installation will be available to *Navion* owners as soon as CAA licensing is completed.

Brown-Graves Co. Offers Passengers Souvenir Book

The Brown-Graves Co., of Akron, Ohio, manufacturers and distributors of commercial millwork, operates a Twin-Beech for business, and has found it both convenient and profitable to use the company plane for bringing customers from distant cities to its Akron plant. In response to innumerable requests on the part of customer-passengers for some sort of souvenir of their flight in the Brown-Graves Twin-Beech, the company produced a small booklet, entitled "Welcome Aboard," which it gives to each customer-passenger at the start of each flight. Numbering 16 pages, the booklet tells the story of the company plane, its operation, and its equipment. Included also are details about the crew, an explanation of popular flight-operation terms such as CAVU, Roger, Out, Over, Wilco, etc., and a passenger flight log for each guest-rider to keep a record of his particular flight.

Harold Graves, Jr., vice president of the company, reports the booklet has proved to be of great value to the company in its business relations with customers in distant cities. The Brown-Graves Company is a member of the Corporation Aircraft Owners Association; Captain of the Twin-Beech is Lee Balestra, copilot is Donald W. Miller.

Long-Range Weather Forecasting Service Offered

Long-range weather forecasting in the form of a monthly weather map is now being made available at low cost by Blewett Weather Service, of Pasadena, California. A pioneer in climatological-meteorological research, Blewett Weather Service issues a map which predicts weather conditions 30 days in advance for each month of the year, by days, cities and areas in the United States. In addition, expected rainfall and anticipated average temperatures are provided, by cities. The map is printed in three colors, and is 11¼ by 17½ inches in size. The maps are available, individually, on a yearly subscription basis, one map sent each month, two weeks before the month predicted.

The Blewett Weather Service was formed in 1940 by Stephen E. Blewett, researcher and teacher of long-range weather forecasting. During the war, Mr. Blewett was engaged in weather research for military uses

EXECUTIVE NAVION used by Fletcher Aviation Corp., is equipped with exhaust augmenter to pull heat away from engine, enabling more power to be drawn from Continental powerplant

at the California Institute of Technology. With this background of research and working closely with the Department of Commerce and the Weather Bureau, Mr. Blewett has made an enviable record of accuracy in his weather predictions over the years.

The company offers more information and a free 30-day weather map by writing to 919 E. California St., Pasadena, Calif.

PAC Becomes Main Suppliers of Dove Airframe, Engine Spare Parts

Under a new agreement between De Havilland Aircraft Co., Ltd., of Hatfield, England, and Pacific Airmotive Corp., of Burbank, California, PAC becomes main supplier of De Havilland *Dove* airframe engine and propeller spare parts, complete spare engines, and quick-change powerplants and propellers for the United States. This is expected to bring about a general improvement in the efficiency of the organization for the marketing of *Dove* aircraft and spare parts in this country, and also to speed up customer service. To facilitate this, a $350,000 stock of spare parts will be maintained at PAC's Eastern Region headquarters at Linden, New Jersey. Facilities will be established for the overhaul and/or repair of *Dove* airframes at Linden, and other plans are being formulated to equip the Burbank, California facilities with parts and tools, so that *Dove* owners on the West Coast can be similarly accommodated.

PAC will be exclusively responsible for the overhaul and testing of *Dove* engines and accessories, and will be exclusive distributors for *Dove* aircraft and spare parts on both the East and West Coasts. In the future, all *Doves* will be ferried from England to PAC, Linden, N.J., where they will receive a thorough check to insure the aircraft are in first class general and mechanical condition, prior to delivery to De Havilland distributors.

AIR is pulled over top of cylinders and sucked out augmenter tubes at the bottom

. . . in the Corporate Hangar

Turner Halsey & Co.'s new Twin-Beech has just been delivered by Atlantic Aviation, Teterboro, N.J. AA installed a custom instrument panel incorporating a new type instrument rim lighting. Pilot of the Turner Halsey D18S is Ray Moulton.

Pilot Don McLott and his copilot, Walter G. Olson flew the McLouth Steel Grumman *Goose* to Southwest Airmotive for a 50-hour check, heater installation and some minor repairs. Home base for the plane is Detroit.

Celanese Corporation's DC-3 is in the hangar at Remmert-Werner, Inc. for installation of new radio equipment and some interior re-work. Chief Pilot Howard Zbornik and Pilot Clint Housel flew the ship in from Morristown, N.J., where it is temporarily based while Newark Airport remains closed to civil operations.

Andy Speyer of Kraft Foods, Chicago, had his company's Twin-Beech at Butler Aviation for 100-hour check.

Miller Industries, of Elmira, N.Y., has sold its Grumman *Widgeon* through Powers & George to El Marques Del Merito of Havana, Cuba. Miller Industries also operates a Ryan *Super Navion 260*. Al Button is pilot.

Pacific Lumber Company's newly purchased De Havilland *Beaver* has a new radio installation. Work was done by Pacific Airmotive at Burbank, California. Pilot Barney Evart and copilot Phillip Kaufeld also brought their company B-23 to Pacific Airmotive for complete airframe overhaul, new radio and new interior work.

Bob Kusse and Rupert Phelps of Fruehauf Trailer Company have been test flying their newly converted Lockheed PV-1. Work was done by Remmert-Werner at St. Louis, and included structural re-work (fairing in the aft end of the fuselage and the nose), installation of 185-gallon nose tank and 485-gallon belly tank as well as a 20-gallon oil tank, relocation of the main entrance door, the controls under the floor, and the alcohol and battery compartments to the aft end of the ship. The aircraft's very elaborate equipment includes a Sperry A-12 Auto-Pilot and a Janitrol heater.

Benton & Bowles' Twin-Beech is undergoing an annual inspection in the Atlantic Aviation shops at Teterboro, N.J.

Gene Parrott and Fred Allen, pilot and copilot of the Fuller Brush Company's Grumman *Mallard*, have flown the ship back to East Hartford, Connecticut, following a complete radio installation by Southwest Airmotive at Dallas.

General Electric's DC-3 is at AiResearch Aviation, Los Angeles, for a custom interior. Buell Warner of GE is seeing the ship through the processes.

Swede Johnson brought El Paso Natural Gas Company's *Lodestar* to Southwest Airmotive for interior conversion, double engine change and repairs to the nose section.

Hollingshead's *Mallard* has been at Atlantic Aviation for installation of an A.R.C. Type 15C Omni with R89B Glide Path receiver. Two A.R.C. T-11A VHF transmitters also were added. Chief Pilot is Dick McNally.

A repaint and installation of a special interior is being given the Minneapolis-Honeywell DC-3. Bob Huckel of M-H, Minneapolis, is overseeing the job.

Matty Springer and George Strosahl of Great Lakes Carbon Corp. flew that company's DC-3 to Remmert-Werner for a thorough check, some interior changes and an exterior paint job.

Dan Spach has been put in charge of Maintenance at Butler Company, Aviation Division, at Chicago, and Al Sorenson, formerly of Butler's Washington Division, has been brought to Chicago to be manager.

Safe Flight Instrument Corp. has brought their newly purchased Twin-Beech to Atlantic Aviation at Teterboro for 100-hour inspection and installation of a Lear L-2 Autopilot and Safe Flight stall-warning system.

CAOA REPORT . .

CORPORATION AIRCRAFT OWNERS ASSOCIATION, INC.

Corporation Aircraft Owners Association is a non-profit organization designed to promote the aviation interests of the members firms, to protect those interests from discriminating legislation by Federal, State or Municipal agencies, to enable corporation aircraft owners to be represented as a united front in all matters where organized action is necessary to bring about improvements in aircraft equipment and service, and to further the cause of safety and economy of operation. CAOA headquarters are located at 1029 Vermont Ave., N.W. Washington 5, D. C. Phone: Metropolitan 0714.

New Members

At a recent meeting of the Board of Directors of Corporation Aircraft Owners Association, the following companies were elected to membership:

Sprague Electric Co., of North Adams, Mass. The company operates two *Navions* and a Twin-Cessna. Robert C. Sprague Jr., is the pilot.

Radio Corporation of America, Camden, New Jersey. RCA operates an executive DC-3, and George W. Lenderman is the pilot.

Miller Brewing Co., of Milwaukee, Wisconsin. The company operates a Twin-Beech, a Grumman *Mallard,* and two Cessna 170A's. The chief pilot is Joseph J. Laid.

CAOA Cooperation

With the closing of Newark Airport recently it was necessary for corporate owners of aircraft to divert their landings to LaGuardia and other airports in the New York area. It immediately became apparent to officials that with the tremendous increase in traffic at LaGuardia they would have to request that aircraft operators refrain from using that field whenever possible. CAOA requested by letter to all its members that in the spirit of cooperation they endeavor to avoid using LaGuardia during this period of Newark being closed. Official figures to prove that the corporate aircraft owners have cooperated is reflected in the LaGuardia traffic report issued by the Port of New York Authority.

In March of 1952 there were 845 corporation landings at LaGuardia, and due to CAOA's request that this be curtailed during the Newark emergency, we can report that for the month of April there were only 155 corporation landings.

Antenna Hazard

Following the recent lifting of the freeze on TV stations by the FCC throughout the United States, CAOA has been monitoring all proposals of the FCC and CAA in the erection of the ultra high frequency (UHF) transmitters. These transmitters require towers between 500 and 2,000 feet high.

The Corporation Aircraft Owners Association feels that since air transportation and TV are both in the public interest and are a necessity, a suitable compromise within all agencies concerned will be attained. It is very obvious that towers will have to be erected in many communities throughout the United States and, if not located properly, could become a definite hazard to all types of flying. From our observations, all agencies concerned are cognizant of this fact, and it is felt that a mutual agreement will be reached.

Rickenbacker Committee

CAOA has been actively engaged in the efforts being made by the National Air Transportation Coordinating Committee, of which Capt. E. V. Rickenbacker is Chairman, to work out a solution of the problems which resulted from the tragic sequence of events involving Newark Airport. Approach patterns are being studied and recommendations are being formulated.

Bedford, Mass. Airport

At the time of writing, no progress can be reported in forestalling the military's decimation of Bedford Airport as a useful civil air facility. To date, Governor Dever of Massachusetts has agreed to a 25- plus 25-year lease to the Air Force, granting use of all the airport and the surrounding area with the exception of about 100 acres on the southwest side of the field, which area to be used solely for civil operations. This also means as part of the agreement that of the total flying at Bedford, only 20 per cent will be civil. In order that the lease be final, it was required that the Civil Aeronautics Administration also sign this agreement. This the CAA has refused to do because it would 1) restrict civil operations at the airport, and 2) it proposes Air Force construction of permanent buildings on what is now permanent and lighted runway 17-35.

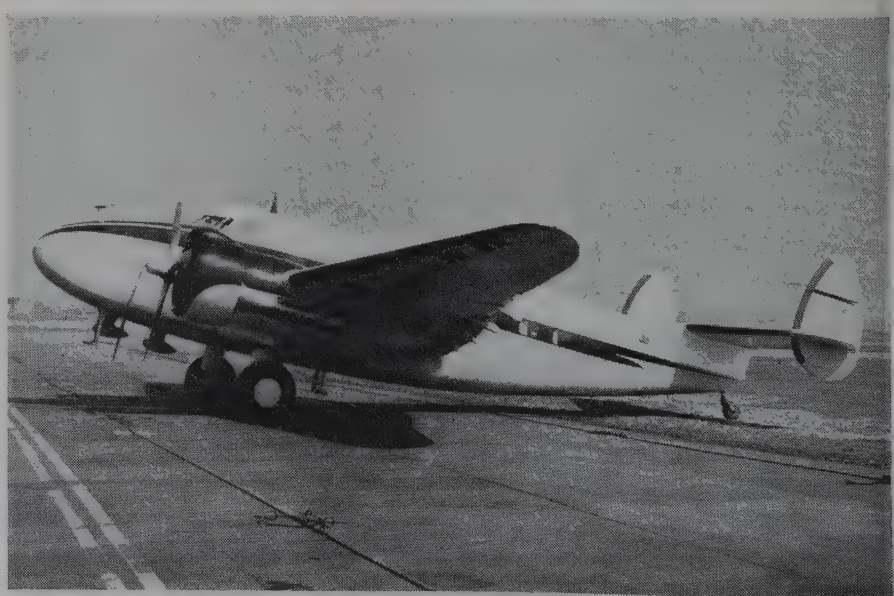
When the matter was brought before the Airport Joint Use Panel last October, John Griffin, President of East Coast Aviation Corporation, presented an excellent case in the fight for the retention of good and continuous civil operations out of Bedford Airport and challenged the legality of the Hearing because the Air Force had improperly stated the problem under consideration. The Joint Use Panel rendered no decision on the case. More recently the Air Space Sub-Committee refused to go along with the Air Force's occupation of the field because the Air Force planned to operate an All-Weather Jet-Interceptor Group, an operation considered to be extremely dangerous for this area because of the two heavily traveled civil airways in and out of the Boston area and a definite hazard to overhead traffic.

When the CAA refused to sign the agreement. Governor Dever and the Air Force simply dropped the CAA from the picture.

Right now, the Air Force is going ahead with its plans, and civil aviation has been allocated 100 acres of swamp land on the southwest side of the field. No construction or filling in of this land to make it useable has been started, and when work does start, it will take about a year to complete. In the meantime, civil operations at Bedford may be put on a "do the best we can" basis. Although some concern has been expressed over the possibility of the ILS at Bedford being shut down, the CAA has stated that it will continue this operation. Should this picture change, however, it would mean the civil corporate users of Bedford would have to seek facilities elsewhere.

Through its member companies in the Boston area, CAOA will endeavor to keep its members informed regarding the operations at Bedford.

PLYMOUTH OIL CO. owns and operates this Lockheed *Lodestar* in addition to a DC-3, a Twin-Beech and a Cessna 195. Pilot of the *Lodestar* is Stanley N. Siggins, based at Pittsburgh



EXECUTIVE PILOTS based in the St. Louis area met with CAA officials at Remmert-Werner to discuss executive operation problems

Executive Pilots Meet With CAA

The increasing importance of executive aircraft operation to American business is clearly evidenced in the growth of the corporate-plane fleet. According to a report from the Corporation Aircraft Owners Association, there are presently over 9,000 aircraft owned and flown by American business in the furtherance of its activities. Contrast this to the estimated 2,000 aircraft that were owned and flown by and for private enterprise back in 1946.

Mindful of this continuing growth of the executive aircraft fleet and its great importance to industry and, consequently, the economic security of the nation, the CAA's St. Louis District Aviation Safety Office called together a group of executive pilots in that area for a panel discussion meeting at Lambert Field, St. Louis. Purpose of the meeting was to provide the executive pilots and key personnel of the CAA, Weather Bureau and the airport an opportunity to discuss mutual problems and, through discussions, to open up channels of improvement in the operation of executive aircraft.

The panel selected to discuss specific problems with the executive pilots included David Leigh, Lambert Field manager; Glen Bowie, Chief Airport Meteorologist; Oliver Hasek, CAA Senior Air Route Traffic Controller; Marion O'Brien, CAA INSAC; Paul Vinyard Jr., CAA, Lambert Field tower; Gordon Williams Jr., CAA Air Carrier Operations Agent; Edwin Schaeffer, CAA Airman Agent; and Edwin Michelsen, CAA Aircraft Maintenance Agent. Also at the meeting to contribute clarification to executive-operation problems were R. W. DeLany, Chief, Safety Operations Div., CAA Fifth Regional Office, Kansas City; Paul Flanary, Chief, Airman Standards Branch, Fifth Regional CAA office; and William Clarke, Chief, Flight Operations Branch, Fifth Regional Office.

The following is a summary of the questions that were raised by the executive pilots, and the answers that were given to them:

Authorization for Lower Instrument Approach Minimums.

All aircraft are required to conform to the landing minimums specified in the Flight Information Manual unless the operator holds a specific authorization for lower minimums. If the operator's equipment, pilot's experience and competency, training program, etc., warrant it, lower minimums *can* be authorized on a Certificate of Waiver.

Any corporation desiring lower landing minimums should submit an application to its local CAA Aviation Safety District Office on Forms ACA-400 requesting a Certificate of Waiver for Section 60.46 of the Civil Air Regulations, setting forth a list of all aircraft, pilots, airports and minimums requested to be utilized at each airport listed under the terms of any such Certificate of Waiver which may be issued. The application should also contain detailed information as to the instrumentation of the aircraft, the experience of the pilots, the training program which is or will be utilized to maintan the proficiency of pilots operating under the Certificate of Waiver and any other pertinent information.

A flight test for each pilot covering the types of approaches (ILS and/or range) for which lower minimums are requested will be conducted.

Lower minimums may be authorized for both ILS and range approaches. However, only standard instrumentation including ILS may be utilized during the flight test. The use of the Zero Reader and/or automatic approach devices (autopilots) cannot be permitted, since the operational experience with the Zero Reader and automatic approach devices is not sufficient at this time to determine whether those instruments in themselves will make lower minimums justifiable. In other words, the pilot's competency using standard radio and standard ILS equipment will be the determining factor.

It will be necessary to list each specific airport and the minimums requested therefor on the application. In this connection, it is suggested that the most practical solution would be for application to be made *only* for those airports which are frequently used by the particular pilots involved.

The special provisions on the Certificate of Waiver will include a requirement that the pilots successfully accomplish a periodic six-month instrument competency check, and a requirement that a competent copilot be carried. Additional details concerning this may be obtained by personally contacting the Regional CAA Aviation Safety Office.

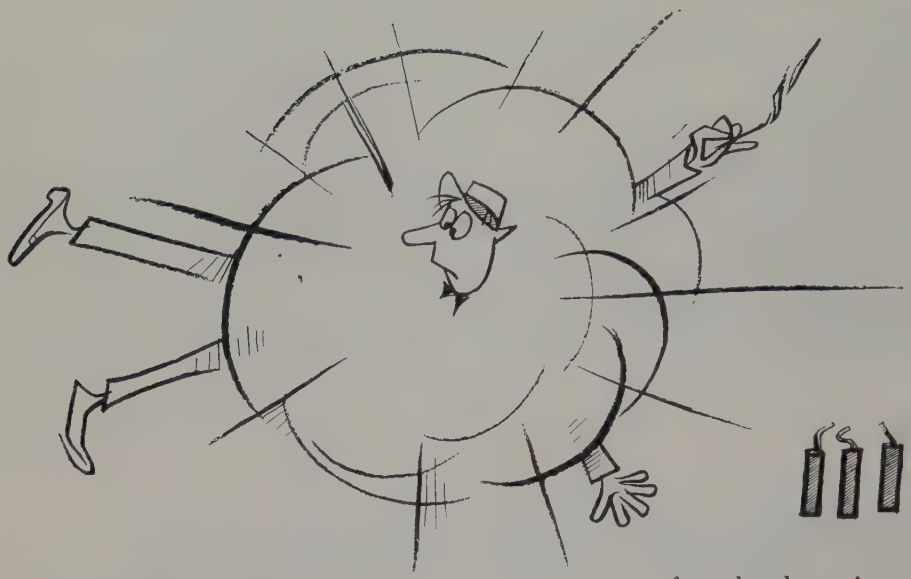
Pilot Training Program.

Considerable discussion was held as to how a satisfactory executive-pilot training program could be set up by the various companies represented at the meeting. Several suggestions were made including the joint purchase of a Link trainer and the establishing of a cooperative joint training program by all those corporations interested. Mr. Flanary, CAA, inquired as to the feasibility of a regional or possibly a national training program or school for just such operators. The pilots reported there were two or three such schools already established in the country but they felt that it would be better for their particular group to get together as a unit in St. Louis rather than attempt to spare crews to attend training programs located outside the St. Louis area.

How Valid Is Cockpit Weather?

In connection with instrument approaches, the weather is considered to be the last reported by the (*Continued on page 50*)

DILBERT



By S. H. Warner
and R. Osborn

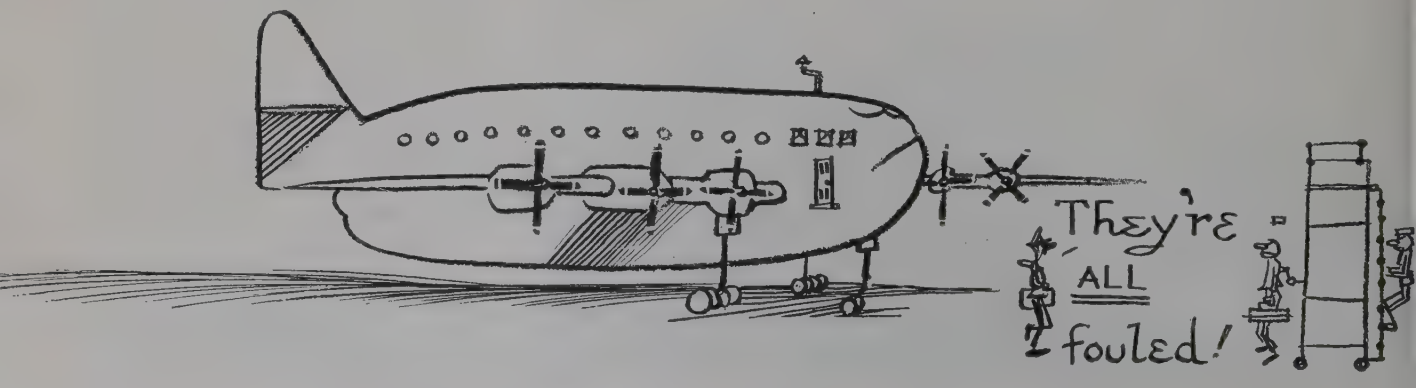
Mag Checks in Flight—Being a super-careful pilot, Dilbert always rechecked his mags in the air after he settled down in "cruise." Always, that is, until he developed so much engine trouble and required so many plug changes that the engine experts started investigating. They found he was super all right—super dumb. Here's the dope; it may prevent you from being similarly dubbed.

The whole trouble was that Dilbert was making these mag checks with a lean mixture. With such a carburetor setting, it was perfectly natural, therefore, that the engine would, and indeed did, backfire.

You see, with a lean mixture, a lower flame speed results. With one plug cut out, this does not allow sufficient time to complete combustion and scavenge the cylinder by the time the intake valve opens for the next cycle. The still-burning charge ignites the incoming charge and the result is a backfire.

So always use a rich mixture when making a mag check in flight. Anyway, it isn't necessary to make a mag check at the beginning of a flight. After your ground check, the take-off and climb show that the plugs are functioning properly. Plugs are most likely to foul and short out after extended cruising. This is particularly true at low or moderate powers and with cylinder head temperatures below the recommended range.

In order to prepare for possible plug changes upon landing, there is no harm in making a mag check near the end of the flight, prior to let-down. But be sure your carburetor setting is "rich," and your cylinder-head temperatures are in the normal range. Then, if the engine indicates roughness or otherwise unsatisfactory (*Continued on page 52*)



"Dilbert thinks flying begins with the take-off. Result—taxi catastrophe."

Nato Air Power

(*Continued from page 12*)

considerable increase in combat strength and the re-equipment of existing squadrons, the 2nd Tactical Air Force on the Continent coming in for the lion's share of the increases.

All day interceptor squadrons have now been re-equipped with the *Meteor* F.8 fighter, and all 20 Royal Auxiliary Air Force fighter squadrons have now swung over to jets, but there is much concern over the lack of *modern* fighters, for those being supplied were, after all, designed during the war years. The reason for this uphappy situation in which the RAF finds itself is to be found in the initial caution shown in ordering replacement jet fighters which was exaggerated to a degree where the first British airframes with Rolls-Royce *Nene* engines, the *Attacker* and *Seahawk* naval fighters, are only now entering service—more than two years after the first Russian fighter to be *powered by a* Nene-*copy!!*

Prime Minister Churchill has given *superpriority* to the production of the Hawker *Hunter* and Supermarine *Swift* day interceptors, but even so, the RAF is unlikely to have anything like adequate numbers of these interceptors much before 1955-56, and as an interim measure, 400 F-86 *Sabres,* the airframes of which are to be built in Canada and the engines and equipment supplied by the U. S. under MDAP, will be delivered to the RAF to form the spearhead of Britain's immediate contribution to NATO air strength on the Continent. The *Sabre* elements will be supported by a number of squadrons equipped with de Havilland *Venom* fighters to be formed this year.

The end of this year will see the completion of the re-equipment of the RAF night-fighter squadrons with jet fighters. Their equipment will be *Meteor* N.F. 11 and *Vampire* N.F. 10 two-seat fighters, to be joined later by the *Venom* N.F. 2 but, although capable of intercepting bombers in the B-29 class that would probably be employed by the Russians for night attack, should an open clash develop within the next two years, the RAF does not pretend that substantial improvements in performance, endurance and armament are not already desirable. The airplanes at present being delivered fall far short of the standards which will be established by the de Havilland D.H. 110 and the Gloster G.A. 5 once service deliveries of these formidable machines commence. Unfortunately, both the D.H. 110 and the G.A. 5 are only undergoing makers' trials at the time of writing and no production orders have been announced. It is, therefore, most unlikely that either airplane can make its service debut much before 1956.

NIGHT-FIGHTER SQUADRONS of the Royal Norwegian Air Force currently fly the *Mosquito* Mk 6. Norway expects to have 11 operational squadrons flying *Vampires,* F-84's in 1953

The *Canberra* light bomber is now in service with the RAF, two or three squadrons having received their new equipment, and more than a dozen squadrons should be in service in the British Isles and with the 2nd Tactical Air Force by the end of the year, by which time the Short, Handley Page and Avro plants will begin to add their deliveries of this airplane to those of the parent company, English Electric. Apart from the *Canberra,* RAF Bomber Command must operate obsolescent Avro *Lincoln* and B-29 *Washington* medium bombers (*Washington* is the name by which the B-29 *Superfortress* is known in the RAF, and 70 of which have been supplied under MDAP) until the new Vickers *Valiant* four-jet bomber becomes available.

The first deliveries of the *Valiant* cannot be expected much before 1955, and it will probably be 1956-57 before this outstanding airplane materially strengthens the RAF. Other large bombers such as the Handley Page H.P. 80 and the Avro *Delta* should fly in prototype form this year, but these are long-term developments and unlikely to see service before the early '60's. RAF Coastal Command is re-equipping with Avro *Shackleton* four-motor reconnaissance airplanes and Lockheed P2V-5 *Neptunes,* the latter supplied under MDAP.

The total strength of the RAF rose between April and October, 1951, to 262,000, and was expected to reach 270,000 by April. There is no over all manpower shortage in the RAF at the present time, but there is a shortage of skilled technicians, and a new scheme for the training of technical personnel has been instituted this year.

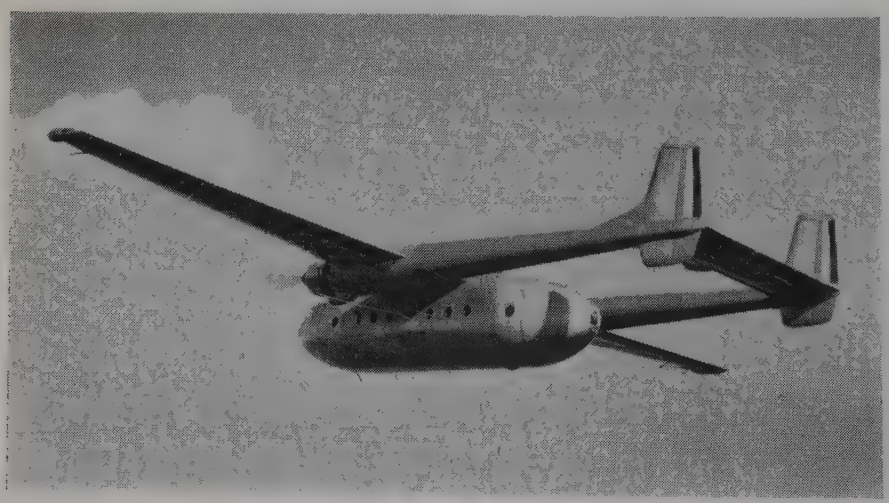
France

On the other side of the channel, France is now beginning to make an important contribution to NATO air strength, a contribution which will be progressively increased during the next few years. This year is the second of the French Five-year Air Rearmament Plan and will, in comparison with last year, call for a much greater financial expenditure, not only for the greater numbers of combat airplanes to be delivered to the *Armee de l'Air,* increases in personnel strength, and the expansion and improvement of ground facilities, but also because of the 25 to 30 per cent rise in costs that has taken place in France during the past few months. Appropriations voted for 1951 totalled some 133,400 million French francs ($3,835,250,00), and it will be necessary to increase this year's appropriations some 115 per cent to maintain the present program at a time when France's overburdened budget is already tottering. Nevertheless, the French Secretary of State for Air has stated that France will meet her commitments towards NATO even if it means *turning every French pocket inside out.*

France's air rearmament commitments call for the manufacture of interceptor fighters, liaison and training airplanes, and medium-sized transports; the development of an extensive ground organization, particularly in northeast France and in North Africa, and a considerable expansion in the first-line strength of the *Armee de l'Air.* Personnel strength was intended to reach a target figure of 91,000 by the end of last year and achieve a 25 to 30 per cent increase this

(*Continued on page 40*)

SNCA DU NORD in France has an order for 180 Nord 2501 *Noratlas,* military freighter externally reminiscent of the Fairchild *Packet. Noratlas* should be available in 1953



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Nato Air Power

(*Continued from page 38*)

year. An "Active Reserve" of *weekend* pilots has been established.

France is receiving substantial quantities of U. S. combat airplanes under MDAP, and a large part of the initial delivery of 100 F-84E *Thunderjets* has already been taken over by the newly formed light tactical support elements, but the bulk of French first-line squadrons will be equipped with nationally produced combat airplanes, the French airplane industry having now succeeded in surmounting its postwar difficulties.

The most important French airplane manufacturers now possess extensive combat airplane production orders on their books. The S.N.C.A. du Sud-Ouest, which has plants at Marignane and La Courneuev, is currently manufacturing Dassault MD 315 *Flamant* communications airplanes, and the fuselages for the Dassault MD 450 *Ouragan* day interceptor. Production of the latter will shortly be shelved in favor of MD 452 *Mystére* fuselages, and the manufacture of spares for the F-84E *Thunderjet* will be commenced. Tooling-up has begun for the license-built Sikorsky S.55 helicopter for the *Armee de l'Air* and production of the *Vampire* fighter is being tapered off and a souped-up version of this airplane, known as the *Mistral*, is now taking its place and will be followed later in the year by the license-built *Sea Venom*, the *Ghost* turbojets for which will be acquired from Italy.

The S.N.C.A. du Sud-Ouest plants at Courbevoie, St. Nazaire, Nantes, Chateauroux and Rochefort, are manufacturing SO-95 light transports, and wing assemblies for the *Ouragan* and *Mystére* fighters. A large military order has been received for the Ariel III turbine-powered helicopter, and apart from current prototypes, a delta-wing all-weather fighter is under development. The S.N.C.A. du Nord, with plants at Le Havre, Les Mureaux, Sartrouville, Bourges and Meaulte, has an order for 180 Nord 2501 *Noratlas* military freighters, externally reminiscent of the Fairchild *Packet*, and for the manufacture of the Bell 47D helicopter. The first *Noratlas* is expected off the assembly line in mid-1953.

The Société des Avions Marcel Dassault, which now possesses plants at Melum-Villaroche, Talence, St. Cloud and Boulogne, is completing its current contracts for MD 315 *Flamant* light transports and has begun deliveries of the MD 450 *Ouragan* day interceptor to *Armee de l'Air* fighter elements. Originally a total of 350 *Ouragans* has been ordered, but production will be discontinued as soon as the more advanced MD 452 *Mystére* begins to roll off the line. Dassault has already a pre-production series of 42 *Mystére* in hand, and will probably commence production of a two-seat night-fighter variant, the MD 453, which is referred to in current Dassault advertisements as the "*Mystére de Nuit*", perhaps inspired by an act in the Folies Bergere. The Louis Breguet works is expected to commence production of the Breguet 960 *Vultur* carrier-borne attack airplane this year, and Societe Morane-Saulnier and S.I.P.A. have considerable contracts for military training airplanes.

The fighter defense of France at present comprises some 12 to 14 squadrons of *Vampire* fighters and two squadrons of *Thunderjets*, but there are being supplemented as the re-equipment of units still flying be-whiskered F-47 *Thunderbolts* progresses. In addition, a number of new squadrons will be formed before the end of the year. The *Mistral* should make its service debut during the summer months and will be joined by the *Ouragan*. However, the *Mystére* is destined to become the standard French day interceptor and should be available by 1954-55.

Belgium

One of the smaller countries participating in NATO air strength, Belgium is making notable progress in her air rearmament. Her defense estimates for 1952 total 20,177,361,000 Belgian francs (about $403,547,200.00) and the strength of the Belgian Air Force has increased by some 60 per cent during the past year and has at present a personnel of approximately 16,500.

Squadron strength has doubled since 1950, and the number of fighter squadrons is to be doubled again during the next three years. The day interceptor squadrons are equipped with *Meteor* 4 and 8 fighters and the tactical support squadrons are re-equipping with F-84E *Thunderjets*. Reserve squadrons are still equipped with *Spitfire* 14's but these planes will be replaced with *Meteors* as they become available. The night fighter squadrons, at present equipped with *Mosquitos*, will receive *Meteor* N.F. 11 jet fighters during the year, and existing airfields are being enlarged and four new airfields are nearing completion. Ten additional fields are also to be constructed in Belgium.

Belgium's small airplane industry is working to full capacity on military orders. The Société Anonyme Belge Avions Fairey, at Gosselies airfield, Charleroi, has considerably increased its plant space during the past 12 months and is building *Meteor* 8 fighters from components supplied by Holland. The Fabrique Nationale des Armes de Guerre is producing Rolls-Royce *Derwent* 8 jets for installation in both Dutch- and Belgian-built *Meteor* airframes.

Netherlands

Belgium's neighbor, Holland, is rapidly progressing towards its target of 21 interceptor and tactical support squadrons equipped with *Meteor* and *Thunderjet* fighters, one transport squadron and several reconnaisance and artillery observation squadrons, which is expected to be reached in 1954. The Fokker concern, which recently took over a new plant at Schipol, near Amsterdam, has now produced 90 *Meteor* 8 fighters largely from components supplied by Britain, and a number of machines completely built in Holland have been delivered, over 100 *Meteors* having now rolled off the Dutch assembly line.

Contracts for the license-built Hawker *Sea Fury* have now been completed, and the Amsterdam plant is engaged in the manufacture of Fokker S. 11 elementary trainers for the Dutch and Italian air forces. The Aviolanda plant at Papendrecht is sharing in the *Meteor* production program and supplies components to Fokker, and the de Schelde plant at Rotterdam is producing the Swedish-designed SAAB-91B trainers under license.

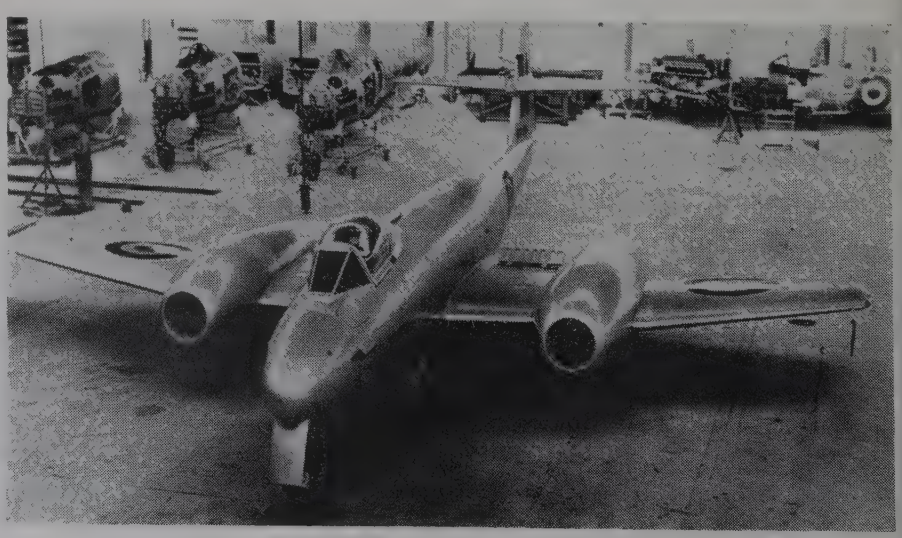
Italy

In the South, Italy's financial difficulties remain unsolved and her current air appropriations are only some 54,000 million lire ($8,640,000,000.00). The additional 55,000 million lire in supplementary credits allocated for the period 1951-54 are insufficient to cover her air rearmament plans, but the Italian government anticipates considerable financial assistance from the U. S., and on the basis of this aid a very extensive air expansion has been drawn up.

At the time of writing, Italy is still bound by the restrictions imposed on her rearmament by the Peace Treaty under which her air strength must not exceed 200 fighters, 150 training and transport airplanes and 25,000 personnel, but if, as is anticipated, the military clauses of the Peace Treaty are repealed, the expansion of the *Aeronautica Militare* (Italian Air Force) and the aircraft industry will be rapid.

There are only 20 usable military bases in Italy at the present time and only four of these (Amendola, Ciampino, Capodichino and Malpensa) are capable of handling jet airplanes. However, 11 other bases are now being established and four of these (Montechiari, Chedi, Canfardina and Aviano) will be suitable for jets. The Italian Government has introduced preliminary legislation for the establishment of an air force personnel capable of supporting an aircraft strength of

BELGIUM is now producing *Meteor* 8 at Avion-Fairey Works for Belgian Air Force. Day interceptor squadrons are flying *Meteor* 4's, 8's; night squadrons will get *Meteor* N. F. 11's



3,000 machines, and plans for this expansion will be put into effect as soon as the Peace Treaty restrictions are removed.

The three *Aeronautica Militare* flight training wings are capable of turning out 600 pilots a year, and technicians will be trained at three schools capable of 3,000 men annually. First-line combat strength of the *Aeronautica Militare* is to be increased to 16 fighter, army and navy cooperation Wings, and by July it is expected that three Wings will be equipped with *Vampire* 5 fighters and three with F-84E *Thunderjets.*

The Italian airplane industry is strictly limited at the present time as, while the combat strength of the *Aeronautica Militare* is limited, only a small domestic market exists. However, the Fiat, Macchi, Ambrosini, and Alfa Romeo concerns are collaborating in the manufacture of *Vampire* fighters and 5,000 pounds thrust *Ghost* turbojets. Some of these jet engines will be supplied to France for installation in French-built *Venoms,* and Italy will also undertake the production of the *Venom* towards the end of this year. Orders have been placed with a number of manufacturers in Southern Italy for spares for the F-84E *Thunderjet,* and two types of basic trainer are on order for training squadrons, the Piaggio P. 148 which is being built at Varese, and the Macchi M. 416 (license-built Fokker S. 11) which is being produced both by the Macchi and the I.M.M. plants. Fiat has begun tooling up for the Fiat G. 80B-2 tandem two-seat jet trainer, and single and two-seat all-weather fighter versions of this airplane are under development. Two new sweptwing single-seat fighters will be completed this year, the Ambrosini *Vindex* and the Macchi M. 324.

Norway and Denmark

No review of the NATO European signatories would be complete without mention of Norway and Denmark, which have the role of northern protecting flank in West European air defense. Norway expects to have a total of 11 operational squadrons by 1953, the equipment of which will be divided about equally between the de Havilland *Vampire* and the F-84E *Thunderjet,* while Denmark will have eight operational squadrons equipped with *Meteors* and *Thunderjets,* and together the two countries will have a grand total of some 300 operational jet aircraft when present expansion plans are fully completed. Neither Norway or Denmark has an airplane industry, although the small Danish Scandinavisk Aero Industri A/S has recently received an order for an initial batch of 15 K.Z. 10 liaison airplanes for the Danish Army. Like other NATO countries, Norway and Denmark have numbers of pilots under training in the U. S. and Canada. This is particularly important at the present time owing to their personnel shortages as it releases many flying instructors for squadron service.

From this report it can be seen that the European members of NATO are playing important parts in the defense build-up. It may be asked why the build-up in fighter strength is based largely on such types as the *Meteor* and the *Vampire* which are now out-dated by world progress, but it should be remembered that these fighters *are in production* and the AAFCE must have fighters *in strength and in time* if it is to be an effective deterrent to aggression within the comparatively near future.

ANOTHER SKYRAIDER is the Navy's AD-5 "Multiplex" bomber built by Douglas. Aboard carriers, AD-5 can be easily converted to a dozen different combat types, according to need

Carrier Operations

(*Continued from page 15*)

had seen—jets of all kinds—light and heavy bombers—fighters. Some of them were good, I knew, extremely effective. But they were limited in various ways. And it came to me in the dark that the AD was one of the ships that carried the ball most effectively in Korea.

The roar below me grew until it was earsplitting. I knew what that meant: It was the final gunning of the engines before takeoff. From over the squawk-box on the bridge came a new course for the task force—in code, of course. We swung to port, and invisible in the darkness, the other ships around us swung as well. I watched the wind speed indicator—20 knots . . . 21 . . . 22 . . . 25 . . . 27 . . . 30 . . . 31. The sea was almost a flat calm, but the *Princeton* herself gave us wind to spare, especially since the planes were to be catapulted this time.

I looked down towards the flight deck and could make out a sort of ghostly activity. The planes themselves were inky patches in the dark. And around them were red lights which danced and dipped like fire-flies. They were neon bars perhaps eight inches long, held two to a man—the plane-handlers. The pilots watched them and only them, trusting their lives to those denim-clad guys on deck.

Forward, a pair of planes moved into position, pointing towards the bow. Invisible figures crept under their tails, fixed the catapult cables to hooks by touch. The other ships gently swung into two lines behind them.

Ten planes in all. Ten men risking their necks, relying on steel and wire and the dimly lit dials in their cockpits for their existence.

There was a final roar. Then the red signals between the lead ships dipped to port and quickly to starboard. My heart stopped as the space where the planes had stood suddenly became empty. I strained my eyes. Far ahead of the *Princeton,* I could barely see two sets of tiny lights on the tips of two pairs of wings. They rose and disappeared.

Four more times, my heart did peculiar things. Four more times, I waited breathlessly for the pin-points to rise—and keep rising. Finally, there was silence. The launch was complete.

Bill Gallery turned. Behind him, there was the beginning of a faint glow in the East. He ignored it, because to him such early risings were no longer news. For nine straight months, he had lived through them and the tension they brought. The men and the planes were his, not only because the Navy had said so but because he was a flyer, too, and he loved them. He knew the risks.

"Made it," he said then, smiling.

I knew there had been mornings when they hadn't. I smiled back.

"They'll hit the beach just at dawn," Bill Gallery went on. "It's a good time to catch things in the open—trains, truck convoys, and such. They'll have good hunting."

My mind went back to what the *Princeton* and her sisters were doing in the war, to what the "jeep" carriers on the West Coast were doing.

"Interdiction" is a new word to most Americans. Or, if they have heard it, they know it in the infantry sense. Simply, it means to cut your enemy's supply lines—and keep them cut, if you can. Formerly it was a limited business of raids on strategic points by small units of foot soldiers, of grenades thrown at railroad tracks, of night forays against supply dumps, and the like. In the Korean War, however, the Navy has led the United Nations forces into a new concept of interdiction, one which thoroughly upset the Communists' Battle plans.

The Navy's method is interdiction from the air.

When the Japanese occupied Korea, they built vast networks of rail lines and, to a lesser extent, roads, principally in North Korea, the industrial center of the country. Since the terrain in the North is a constant

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Carrier Operations

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series of rugged, jagged ridges, they were forced to construct literally hundreds of bridges and tunnels for their trains. This appears now to have been simple for the Japs, for they are and were excellent engineers. The result is that in North Korea alone there are approximately 500 bridges over 200 feet long. There are, too, dozens of tunnels, some of which swallow trains for as long as 20 minutes.

This was, naturally, magnificent for the Communists when the war began. It gave them an edge over us, for there is nowhere near the railroad development in the South, and it was thus much more difficult for us to get our supplies to the front. And the Commies used three main routes: From Sunuiju to Pyongyang and south on the West Coast; from above Kilchu to Wonsan and south on the East Coast; and from Wonsan west across the neck of Korea to Pyongyang. But this again does not tell the whole story. For there were literally dozens of little spur lines interlaced through the mountains of the East, as well as a central North-South route which connected to the Wonsan line. Probably, nowhere else in the world, with the possible exception of our own East, were there as many raiload facilities in a small area as in Northeastern Korea. And on them, of course, the Reds moved ammunition, artillery, food, and men.

Rear Admiral Ralph Oftsie, now chief-of-staff for Vice Admiral Turner Joy in Tokyo and formerly commander of Task Force 77, set out in January, 1950, to stop the stream of supplies going to the Communists—and to do it from the air.

He first aimed at rail bridges. The plan was to keep spans of certain key bridges knocked out, and to frustrate the Commies' effort to re-build them. At the same time, strikes were aimed at road bridges and difficult-to-repair spots in the roads themselves. And at truck convoys, ox-cart convoys, even masses of civilians *when they were with troops*, when they were obviously acting as bearers for the military. And, too, at supply dumps, which could be spotted through their camouflage from the air. And, finally, at the trains which the Commies hid by day in the tunnels along the way.

All of these were legitimate targets. And, though the program spread to include the other services, the Navy's area was by far the largest and it took the major share of the activity. So successful were Ofstie's boys in their constant pounding that by last summer the Communist supplies were being cut 60 per cent consistently, week after week. The Reds were frantically trying to get the wherewithal of war through to their front line units, and, failing, were forced into asking for a cease fire.

How was this done? By whom was it done? I saw it in operation.

The Navy used three planes: the *Panther*, a jet; the *Corsair* and the *Skyraider*. By all odds, the *Skyraider*, or AD, was one of the most effective.

Hitting a bridge, for instance, demands certain things of both plane and pilot. The ship must be fast but not so fast as to prevent the accurate laying of the eggs. It must be maneuverable, both on pull-out at low altitude and in dodging enemy flak and attacking planes. It must have range, hold enough gas to get inland to a target. It must carry a heavy load of explosives and ammunition, for you do not knock out a creation of steel and concrete with a fly-swatter. The AD fulfilled these requirements perfectly.

I have watched the *Princeton's* pilots in AD's take off on a bridge-busting mission. (And nearly always the *Skyraider* was chosen over the jets or F4U's for this type of strike.) We would be steaming through the calmness of the Sea of Japan in the bright sunlight, the whole flight deck alive with whirling propellers. The jets would be nearest the bow, ready for the catapult—the only way they can get aloft from a carrier. Behind them would be a group of *Corsairs*. And, farthest aft, the rough an' rugged AD *Skyraiders*.

The jets would be launched, a few rockets and frags beneath their wings, cannon on the leading edges. Fragile and beautiful in the light, they were gone in an instant, bound for patrol duty, some close support if the terrain was not too rugged, a strafing pass or two, perhaps a dog-fight with a Mig. But they had to return in a little over an hour, due to their fuel consumption. And they were useless for bridge-busting or for most of the work of interdiction because their speed was against them.

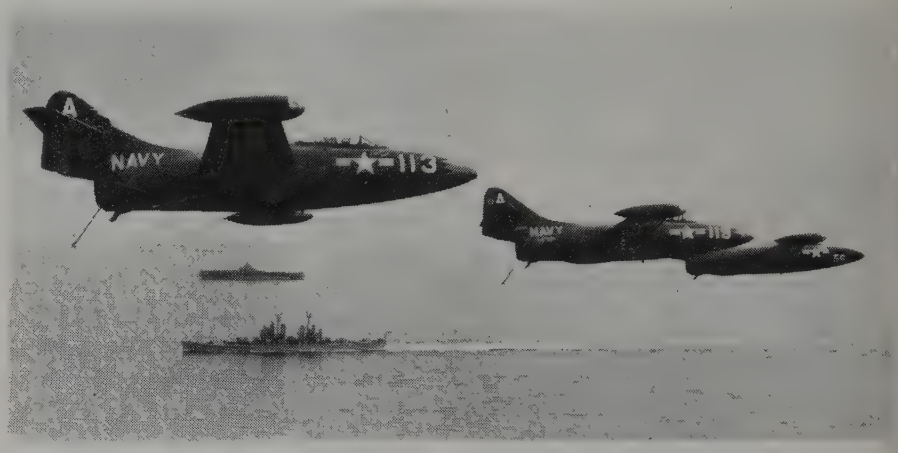
Then the *Corsairs* would roll down the deck, small bombs, rockets, napalm, and .50-cal machine guns loaded on them. Their bat-like wings would be silhouetted against the sky for a few minutes, and they would be gone to do business with the enemy; below tree-top close support, strafing, napalming supply dumps, perhaps knocking out an important stretch of road with their bombs. They very nearly fulfilled all the requirements for interdiction, for they were fast, maneuverable, had long range.

But they could not do what the AD could do. They could not take off—on a *rolling* take-off, mind you—with *four tons* of load aboard, perhaps three 2,000-pound bombs and another ton of frags and rockets. And they could not use that power against a bridge and be sure they had knocked it out, while putting out easily at 1,000 feet and dodging flak like a ballet dancer. Only the AD's could do that, and carry enough gas for a three-hour mission and out-maneuver a Mig if it saw one.

And only the AD could be used against trains in tunnels.

This is one of the trickiest jobs in flying in the world. For the train is out of sight, hidden *inside* the tunnel. You only know it is there because you see wisps of smoke or steam from the tunnel mouth. And, above that mouth, there may be a 60° cliff. You have to dodge that, if you can.

You use either a 500- or 1,000-pound bomb, or a *Tiny Tim* rocket eight feet long. You drive your ship down the tracks leading into the tunnel—at perhaps 50 to 100 feet altitude. Your ammo has a delayed-action fuse and, depending on how it is set, you let fly at the tunnel mouth and pull out desperately to avoid hitting the face of the hill. You have almost no time to do this, believe me, so close are you to the ground and the target. Your plane must respond instantly and surely, so fast that you are upstairs before the blast occurs.



NAVY JETS, Grumman F9F *Panthers*, circle the *USS Boxer* prior to landing aboard the aircraft carrier in Korean waters after a photographic mission over enemy territory

Cdr. Arthur Maltby, C.O. of the *Princeton's* air group, was an authority on tunnel-blasting. He had learned it the hard way.

"We didn't know whether it would work or not," he told me. "It was worth trying, however. We *did* know one thing, though: we knew that the only plane which could possibly do the job was the AD!"

They tried it for the first time in the early spring of 1951. Four *Skyraiders* went out one day, casually got 14 trains which they could not see, and came home for dinner!

The Commies had quite a time removing the debris. The *Princeton's* lads saw them at it the next day.

The AD also has other uses which make it unique. For one thing, it is an all-weather plane, flown by pilots who are specially trained to fly in anything—darkness, snow, fog, rain, anything. It was these boys I saw taking off on that dawn strike, going out to "Heckle," as they call it. And they are good.

They fly by instruments nearly all of the time, and their ships are fitted with special gadgets so sensitive and accurate that almost nothing can bother the pilot. These take room, of course. And the smaller ships' cockpits are not large enough to handle them. The AD's "sitting room" is just right, and, I might add, about as complicated a spot as you can get!

Some of these highly trained gentlemen not only fly combat but also go out on weather

and anti-submarine radar patrol. And for these jobs, too, the AD must carry special instruments, some of them weighing thousands of pounds. In the radar department, particularly, much of the equipment is housed on the outside of the ordinary fuselage, making the ship look cumbersome and awkward. But the boys tell me it flies as easily as it ever did.

It is these pilots, too, who do the flying not only in the early morning but late at night. And their landings are terrifying to watch.

I saw them do this the first night I was aboard the *Princeton*. It was nearing midnight when the call came through that the boys were on their way back. Capt. Gallery had invited me to Primary Fly Control, the glassed-in box just aft of the bridge amidships, perhaps 30 feet above the flight deck. This is the nerve-center of landings and take-offs, and from it the Air Officer is in constant contact not only with a dozen divisions on the vessel itself but with the pilots in the air.

In the dark, I met Cdr. Charles Iarrobino, Air Officer of the *Princeton*.

"They're about five miles out," he told me, as I took the seat beside him. "You'll see them getting into the pattern soon—when your eyes get used to the dark."

The pattern. I had been in it myself that afternoon, in a World War II torpedo bomber which the Navy now uses as a courier plane. We had started to circle several thousand feet in the air, while I look down at the powerful beauty of the formation beneath me. The ships had seemed like toys, steaming quietly in a sunset-pointed ocean. As we came down nearer and nearer, as we went into our last pass only 75 feet above the water, as we swung astern of the *Princeton* to begin our run onto the flight deck, it still seemed incredible that we should be able to land safely. When the hook had caught and my shoulders had strained against the straps which held me, and my neck had snapped forward, I had climbed out dripping with sweat, shaking. Someone had said, "Glad to have you aboard," while the men on the flight deck stared at the woman who had come to call. When I answered that I was glad to be there, they had no idea how true that was!

And now the boys were going to do all that in the middle of the night and a great deal faster!

As my eyes became accustomed to the darkness, I could see the deck crews below me, men in varicolored caps preparing for the landings. Aft, I could make out two rows of dim white lights at the extreme edges of the deck. And, beyond them, I could catch a glimpse of the Landing Signal Officer, his khaki uniform striped with fluorescent bands of orange and green, and his paddles shining faintly in the blackness.

We could hear the planes above us—a flight of 10 AD's. On the *Princeton's* port side, a destroyer quietly moved into position a thousand yards away, a red light on its topmost part as a signal for the pilots overhead.

The commander put a small microphone in my hand.

"When I tell you, push this," he said, placing my fingers over a button, "and say, 'White flag!' "

He got the word that the deck was cleared for landing.

"Now!"

"White flag!" I announced.

A roar went up from the flight deck. A woman Air Officer! They loved it. But instantly they returned to the serious business of the landings.

I could see the first planes at last, swinging wide above the destroyer, making a long, careful sweep behind the *Princeton's* stern. Somehow, as the lead ship jockeyed into position, it seemed to be going a million miles an hour. And it was too high! Much too high!

But I was wrong. The AD swept in, dipped, and with a jolt caught the hook. A crewman dashed out and freed it, and the pilot gunned it down the deck. Another landed immediately, and another, and another.

When they were all down, my back ached with tenseness. Unconsciously, I'd been trying to help them down. And I found I had dug my nails into my palm until it was bleeding.

Over coffee, Capt. Gallery was sympathetic. "I do that every time. But I really needn't. In those ships, they can get down safely any time of the day or night—without prayer."

He was right. They can. And the boys themselves know it, have told me they would rather fly an AD than any plane in existence today.

I only wish we had more of them. As it is, I'm glad they—and the men who pilot them—are on our side.

Incomparable

a pretty girl

The aisle looks a mile long and, at the end of it, a certain young man suddenly is something of a stranger to our June bride. Lou Prothro had no trouble posing for this picture because, just 14 months ago, she went through it all to become Mrs. Elmore M. Klenk, Jr. He's now on active duty with the Air Force. Lou is 19, has blue eyes, blonde hair. (No. 9 in a series of pretty Dallas girls discovered and photographed especially for Southwest Airmotive).

Incomparable

The Hospitality on the 30-Acre Concrete "Welcome Mat" at Southwest Airmotive

SOUTHWEST AIRMOTIVE COMPANY

LOVE FIELD • DALLAS

Voltage Regulations

(*Continued from page 29*)

rose, the potential winding of the main control magnet strengthened the magnetic field and opened the contacts. This opened one of the windings on the relay magnet and nullified the differential action. The relay contacts were then pulled open and the short-circuit removed from the generator field rheostat. This reduced the generator voltage. The reverse action took place when the voltage decreased. Actually, both relays were constantly vibrating so that the changes in generator voltage were very small.

The relay contacts were shunted by a condenser to reduce sparking. The relay contacts carried very small currents so it was necessary to have the regulator act on an exciter field to maintain the bus-bar voltage constant through the exciter. A compensating winding on the main control magnet was connected across the compensating resistor to give the system a rising characteristic to compensate for line drop.

2. The GDD (General Electric) Regulator, was a direct acting rheostatic type with the regulating rheostat a part of the regulator itself. The rheostat consisted of stacks of graphite plates, each plate pivoted at its center. The backs of the plates were separated from one another by insulating spacers and the fronts of the plates by silver buttons. When the plates were tilted forward the silver buttons formed a continuous short circuit and the resistance of the rheostat was at a minimum. When the plates were tilted backward the current path was through all the plates and pivots and the resistance was at the maximum. The value of the regulating resistance depended on the number of plates tilted forward or backward.

A U-shaped iron core was magnetized by a coil connected across the generator terminals in series with a resistor and voltage-adjusting rheostat. A torque armature of iron tended to align itself between the poles of the iron core, but was restrained by a spring. The torque system actuated an adjustable link which in turn operated a rheostatic element through an equalizer bar. A dash-pot, to prevent oscillations, was connected to the torque-system shaft through a leaf spring which actuated as a lever. The spring permitted rapid, instantaneous movement of the mechanism at the instant a change in voltage occurred.

The regulator was normally at rest. If a drop in voltage occurred, the current in the coil decreased and the influence of the magnetic field was decreased. The spring overcame the torque of the armature and the shaft rotated in a clockwise direction, causing a downward pull on the link. This caused some of the plates to tilt forward cutting out some of the resistance in the generator field circuit. The voltage rose and the balance between the spring and the armature was restored. The reverse action occurred with an increase in generator voltage.

The Tirrill and GDD type regulators were in operation for some time and had given satisfactory performance in the low-voltage systems. However, rapid aviation advancement prior to World War II led to the development of larger and more complex aircraft demanding larger and more complex electrical systems.

The introduction of electrically driven flaps, wing-tip floats, bomb-bay doors, and landing-gear systems required small, powerful and efficient electric motors. Higher horsepower engines demanded smaller and more powerful starters. Efforts to develop motors of sufficient horsepower to operate this equipment properly, utilizing the 12-volt electrical system, proved that these units would be of such size and weight as to render them useless in modern aircraft.

In order to decrease the size and increase the power and efficiency of these motors and to have them conform to modern aircraft design specifications, the industry developed the present-day 30-volt, 100- to 400-ampere electrical systems. With the advent of the higher currents the industry engineers again had to change their methods of voltage regulation.

3. The multiple-contact regulator was the logical field in which to experiment. A great deal of success had been attained in the use of multiple-contact regulators in stationary installations. It was with this wealth of knowledge that the aircraft engineers designed their first multiple-contact aircraft regulators.

A great many models of the multiple-contact type regulators were made with many variations. Some of the more prominent types were the Tirrill regulator, the General Electric Regulator, the Westinghouse Regulator, the Step-type Regulator, the Silverstat Regulator and the Vibrating-type Regulator. We shall not attempt here to cover all the regulators upon which the industry experimented.

The Silverstat regulator was composed of a series of leaf springs arranged in a stack having their ends fixed and insulated from each other by fish paper, and connected by conductors to a number of taps between the resistor sections. The opposite end of the leaf springs carried suitable contact members and were biased into agreement with a stop made of insulating material. The stop had a sloping surface to limit the motion of the leaves in one direction and for spacing the free end of the spring leaves out of circuit closing engagement. A driving element driven by a movable arm actuated the the leaf springs away from the stop for current regulation.

The original step-type regulator contained a dynamo-electric motor which was connected across the circuit. A fly-wheel was attached to the shaft of this dynamo. The field strength of the dynamo was so varied as to increase the fly-wheel speed when the load was light. The dynamo then acted as an additional generator driven by the fly-wheel when the load was heavy. A number of resistance sections were connected in the circuit of the field windings of the motor and were controlled by switches. These switches, when closed, short-circuited the resistance sections. The switches were actuated by solenoids which carried the whole or a proportional part of the current supplied by the generator. The solenoids were arranged with different air gaps and a different number of turns so that they responded to different strengths of current, thus controlling the field current.

The vibrating-contact type regulator containing a voltage regulator and a current regulator was the final stage of development in the multiple-contact field in aircraft.

Navy Sub-Stalker

The Navy's newest anti-submarine weapon to join the Atlantic Fleet Air Force is this 36-ton P5M *Marlin* seaplane, designed and built by Glenn L. Martin Company. It contains the most powerful tactical radar of any U.S. aircraft, and is built to haul impressive load of depth charges, torpedoes, rockets, etc.

The voltage regulator and the current regulator were identical in construction except that the current regulator coil was wound in series with the voltage regulator coil and was actuated only when the current exceeded the predetermined setting of the current regulator. This type regulator also contained a reverse current relay which was installed in the system to prevent a reverse flow of current from the battery to the generator when the battery voltage exceeded the generator output voltage. This condition would exist when the generator is operating at low speeds or stopped. The above described unit is presently in use in all types of automotive generating systems.

Although a fair amount of success was attained in the vibrating-contest field, the industry still had the problem of refining these regulators to overcome the necessity for constant repair. One of the problems involved was the development of contacts that would not stick and transfer particles of metal from one contact to another, thus destroying the setting of the regulator. Another problem was devising a method of regulation that would prevent sudden surges of overvoltage from welding the contact points, blowing radio lamps and injuring instruments. At the same time, a constant search was going on for bi-metals which would compensate for the expansion and contraction of the armatures and fingers of the regulator because of sudden changes in temperature.

A new and better regulator had to be constructed and it was apparent that the regulator would have to be of a different design and material than those which were being used.

4. In 1940, Robert Newton of England patented the Newton Armature for use in carbon pile regulation of aircraft electrical systems. This was the first practical and successful application of carbon pile regulation to aircraft electrical systems. In order to appreciate fully the evolution of the carbon pile regulator to its present day efficiency we must turn back the pages of history to the year 1881.

It was in this year that Camille A. Faure, the inventor of the pasted storage battery, was granted a patent by the French Government of the first carbon pile voltage regulated electrical system. This electrical system was designed for use in railroad heating and lighting and consisted of a belt-driven generator, carbon pile voltage regulator, a storage battery and output voltage furnished by the generator, the battery or both. The system was granted a patent in the United States in the year 1888.

The common method of generator control during the 1800's was by the variation of belt tension. With the invention of the carbon pile regulator the control of the generator characteristic was accomplished by varying the generator field current in inverse ratio to its speed.

The carbon pile (Fig. 1) was connected so that it responded to changes in the voltage of the system in the regulation of a constant generator output voltage. The regulator, in its simplest form, consisted of a solenoid with its winding connected across the line. The core of the solenoid controlled a lever which was pivoted at its center. Connected to the other end of the lever and acting in opposition to the solenoid was a spring. This end of the lever had a stud which was in contact with the carbon pile connected in series with the field.

When the voltage in the system rose, because of increased generator speed, the strength of the solenoid increased, overcame the tension of the spring on the lever and moved the stud away from the carbon pile decreasing the pressure on the pile. The decrease in pressure increased the resistance of the carbon pile and the current through the shunt field of the generator decreased in value. A decrease in the current through the shunt field of the generator caused a decrease in generator voltage, which tended to balance the pull of the solenoid and the spring tension. This balance was attained when the generator voltage was again at its proper value.

When the generator voltage decreased, because of a decrease in generator speed, the spring tension overcame the pull of the solenoid and the carbon pile was compressed. This reduced the resistance of the shunt-field circuit, and the current through the shunt field rose, thus increasing the output voltage. The balancing sequence again occurred until the generator returned to its proper setting.

The electrical system (Fig. 2) used for the regulation of both the current and the voltage contained two carbon pile regulators; one placed in the battery circuit and the other in the load circuit. The current regulator was adjusted to a predetermined value so that it would control the generator output and maintain a constant current flowing to the battery. The voltage regulator was adjusted to a predetermined voltage and maintained a constant voltage in the line. Both regulators operated in the same manner except one controlled the current and the other controlled the voltage.

From these two simple circuits and their components was evolved the compact, efficient carbon pile regulators which control the complex electrical systems of our modern day civilian and military aircraft.

Upon declaration of war in 1941, Mr. Newton and the British Government gave the Allies permission to use their patents on the carbon pile regulator. Immediately the entire aircraft industry of the United States applied all their inventive genius towards the refinement of this method of generator output control.

CONVAIR YB-60, new sweptwing eight-jet bomber, recently made its first test flight. Details are classified. Note landing gear is retouched out

With the increased activity in experimentation on carbon pile regulators the industry was able to incorporate many new improvements in the models already in production within a very short period of time. Some of these improvements were the decreasing of the regulators tendency to "creep", the reduction of radio interference to a minimum, the installation of differential and reverse current relays, pilot relays, and resistors to insure a more stable operating voltage, and the development of a separate mounting base and control panel, equipped with a method of quick disconnection, for rapid changing of malfunctioning units.

Upon proving these units under actual flight conditions the aviation industry at last realized that they had a unit that would accomplish all that was necessary in the control of our modern complex aircraft electrical systems. Most important of all it was of the proper size and weight to make it applicable to any desired installation or aircraft design. These factors combined with American ingenuity for mass-production, aided greatly in a quicker termination of the war through our vastly improved air power.

The carbon pile regulator (Fig. 1) is typical of the units used in our present day electrical systems. The regulator shown is the Eclipse-Pioneer 1539 Control Panel. This unit consists of two separated assemblies, one the mounting base assembly, which is bolted directly to the airplane structure and incorporates terminals for external connection, and the control panel assembly which is mounted on the mounting base assembly. The control panel consists of a carbon pile voltage regulator (Fig. 2) and a relay assembly together with the associated wiring and resistor required for proper operation.

The voltage regulator operates as a variable resistor by controlling the resistance in the shunt field current of the aircraft generator. The carbon pile is connected in series with the generator shunt field circuit. The controlling shunt coil is connected through a resistor and the voltage adjusting rheostat, across the generator output voltage.

When the engine-driven generator is at rest, no current flows through the regulator shunt coil and the diaphragm-type arma-

(*Continued on page 46*)

Voltage Regulations

(*Continued from page 45*)

ture assembly compresses the carbon pile to its static minimum value of less than one ohm.

As the generator increases in speed, its voltage builds up and causes the regulator shunt coil current to increase. As this current increases the force of attraction on the diaphragm-type armature assembly is increased. This force on the armature assembly contact plug decreases the force on the carbon pile. As a result, the resistance of the carbon pile is allowed to increase until the generated voltage has increased to the regulator voltage setting and an equilibrium condition is established. At this time the pile resistance has increased enough to prevent a further rise in generator voltage. Should the generator voltage tend to fall below the voltage setting the resistance of the carbon pile decreases and the generator voltage returns to the voltage setting. In this way the regulator automatically regulates the generator output voltage.

A 330-ohm resistor connected in the circuit suppresses the effects of inducted voltage from the open shunt field. In this way "hunting" of instability in the regulator is prevented.

The line switch control has two polarized relays; the differential voltage and reverse current relay and the pilot relay. These are mounted on the control panel assembly. The reverse current differential relay controls the aircraft line switch connected between the generator and the positive bus. The polarized pilot relay serves a double function. One function is to protect the differential coil of the differential and reverse current relay from excessive differential voltages and the other function is to control the operation of the paralleling relays. We shall discuss the construction and function of these relays fully in our next article.

As shown in Figure 2, the voltage regulator does not use the Newton armature. It has a diaphragm-type armature. Other type carbon pile regulators use what is commonly known as a bellvile washer. The reason for the introduction of this type of armature was the fact that the industry could not manufacture the Newton type armature in mass-production and maintain a consistent tolerance in their production runs. Also the use of this armature increased their ability to control temperature compensation. At the moment the industry is experimenting still further with a new armature called the "Tepee-type" armature. This armature will allow a still greater refinement of the operation of the carbon pile regulator. Electronic trimming of the regulated voltages is also being utilized at present.

Although the industry has experimented and is experimenting in many fields with regard to voltage regulation, the carbon pile regulator is still the most practical unit available from the standpoint of weight, size, serviceability and cost. The electronic tube is being used, in some instances, for voltage regulation but at present has not been refined to a state where it can replace the carbon pile. But what methods of regulation of electrical systems we shall have in the future can only be told by time and the inventive genius of the engineers.

SCORPION'S cannon fire 20-mm shell *(in engineer's right hand)*. Photo shows visual comparison between 20-mm shell and the smaller, less destructive .50-caliber

Aircraft Identification

(*Continued from page 21*)

edge taper begins outboard of the engine nacelles and provides the wing with a distinctive "kink" between the engines. Both engine nacelles and wingtip tanks are carried at an unusual angle of "droop," giving the *Neptune* a noticeable tail-down sit in the air.

Data—Span: 100 feet; length: 78 feet. Power: Wright *Cyclone* R-3350-30W radials. Armament: two 20-mm guns in nose, two 20-mm guns in tail turret, and two .5-in. guns in dorsal turret.

The Ilyushin and B-57A *Canberra,* twin-jet tactical intruder and ground attack airplanes, will achieve considerable prominence during the next few years and will be seen in gradually increasing numbers. The Ilyushin airplane (hitherto thought to be a Tupolev design) is already widely used by Soviet tactical elements and is likely to be seen in Korea. The B-57A *Canberra* has been ordered in large numbers by the USAF, while the RAF is building up squadron strength with the version shown in our drawing and known as the *Canberra* B.Mk.2.

Lacking the aerodynamic refinement of the *Canberra,* the Ilyushin is unlikely to present difficulty to the student of airplane recognition, for the combination of distinctive features embodied in its design is unmistakable. Like the P4M-1, the nose of the Ilyushin is stretched out well ahead of the wing, but unlike the Navy's airplane, the engine nacelles of the Ilyushin are also forward slung and the result is a striking nose-heavy sit in the air. The wings are set more than halfway back on the fuselage and lack of noticeable fillets give them a square-cut, crisp appearance. The most useful recognition feature is the marked tail sweep which, with the straight wings, produces a remarkable contrast of angles in the plan view. In the head-on view, a noticeable feature is the tremendous girth of the turbojet nacelles, the circumference of which is similar to that of the fuselage.

Data—Span: 68 feet (approximate); length: 60 feet. Power: two axial-flow turbojets. Armament: two 20-mm or 30-mm guns in nose and one or two 20-mm guns in tail turret.

The *Canberra* is a sleeker and more graceful airplane than its Russian contemporary, and its chief characteristic is the exceptionally low aspect ratio of the wings which strike the eye from nearly every angle except side-on views. The great wing center section with straight leading and trailing edges gives way, outboard of the engines, to pronounced taper on both edges, ending in blunt rounded tips. The jet nacelles project very slightly fore and aft and form slender humps on both top and under surfaces of the wing. The fuselage is a circular sectioned body with a long, straight top line. On the underside, aft of the wing trailing edge, the contour rises at an angle in a straight line to the tail cone. The tail unit of *Canberra* is distinctive: there is a dihedral tailplane with sharply tapered leading edge and straight trailing edge. The fin and rudder combination is (optically) low, broad and flat-topped. A feature of the *Canberra* in flight is its peculiar way of seeming to slide or "float" through the air.

Data—Span: 64 feet; length: 65 feet 6 inches. Power: (B.Mk.2) Two Rolls-Royce *Avon* turbojets; (B-57A) two Wright J-65 *Sapphire* turbojets. Armament: (B.Mk.2) none, (B-57A) not available.

Twin Tri-Pacer

(*Continued from page 19*)

airport for about five minutes. He then taxied out to the end of the runway, opened the throttles and the "Twin" jumped into the air. That morning many jaws dropped at the sight of the "Wagner Twin" in flight.

The plane handled like a dream and got off the ground like a rocket. Wagner maintained there was loads of extra power at hand and that the safety factor was greatly increased as the result of the extra motor.

The high safety factor, was, of course, one of the main reasons for the installation of the extra powerplant.

Because of there being two engines, each one can be kept at a lower speed and still operate better than if there were only one. Hence, the life of the engine is increased with a longer period between overhauls. The two engines are not geared to each other, both props operating independently of each other.

The ship will take off and fly with one engine as well as two. Thus, if one engine were to fail, the plane could still make it to the nearest field. Wagner states that with his overlapping design his plane is as easy to fly with on one engine as with two. No trouble is found in making turns in either direction with one motor off, and only a little extra rudder is required to hold the ship on course.

The pilot and passenger sit in the right fuselage. While the ship has space for four, the wing loading would be too great with that many.

Top speed is 120 mph instead of 100, cruising speed is raised at 100, and fuel consumption is about eight gallons per hour, only three more than with the single motor. Rate of climb has been increased to 1500 fpm—it was 800 with the single engine.

The second ship Wagner built is a "Twin" *Tri-Pacer*. Two 125-hp Lycomings were mounted 20 inches off center from the thrust line and 11 inches toward the rear. A little weight was added to the tail to bring the ship within cg limits.

A spacer block was added to the crankshaft of one engine to allow proper clearance between the props. The spool is four-and-three-fourths inches long and is fashioned from Hi Test 4142 steel. The spool is bolted to the crankshaft while the propeller is bolted to the other end. The two propellers on the "Twin" *Tri-Pacer* clear each other by two-and-one-half inches!

This second Wagner ship was redesigned in three weeks and was test-hopped on February 8, 1952. In this ship Wagner achieved what he started for—safety of two engines at low cost. The total cost was under $9,000. This Wagner *Pacer* will carry four persons easily. A comparable twin-engine ship on the market sells for $50,000.00 and will carry five.

The performance figures on the new ship are as follows.

Tri-Pacer, single motor		Wagner-*Pacer*
Top Speed:	140 mph	160 mph
Cruising Speed:	120 mph	135 mph
Stalling Speed, power on:	45 mph	45 mph
Rate of Climb:	1,000 fpm	2,000 fpm
Gas Per Hour:	8 gallons	12 gallons

Wagner now flies the smallest twin-engined ship in the States and the only one to have overlapping propellers. For comparatively little money he has a ship that he can fly anywhere with the high safety factor of twin engines.

The "Twin-*Cub*" now has more than 50 hours in the air while the newer Wagner "*Tri-Pacer*" has about 15 hours. The name "Wagner-Twin" is registered with the CAA and patents are pending in Washington on the designs.

Mr. Harold Wagner is part owner with his six brothers of a firm building contracting equipment in Portland, Oregon. His products are sold and used all over the world.

Future plans? Wagner plans on flying the newest twin to iron out all bugs. Next year, if tests go all right, he expects to begin building small low-cost twin-engined ships of his own design. Only time will prove—or disprove—Harold Wagner's ideas.

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Only TWA offers one-airline service from 60 U.S. cities to Europe • Africa • Asia
See your TRAVEL AGENT or call Trans World Airlines
Across the U.S. and overseas... you can depend on
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TRANS WORLD AIRLINES

WAGNER TWIN CUB, warming up on the line, carries pilot and passenger in right-hand side. Engine throttles operate independently of each other. Plane will get off on one engine

Salvage by Air

(Continued from page 17)

Rankin, his shoes thoroughly covered with mud by now, splashed from the wreck to the waiting helicopter carrying the detached parts which he described as "anything of value to the population." He glanced thoughtfully at his footwear, and ventured a guess as to what would happen were he to ask his wife to reshine them.

By late afternoon the two 'copters were loaded with the loose gear from the wreck, and the crew returned by air to the squadron area. From there another whirlybird set out to carry two sentries to protect the plane from scavengers, but darkness and a sudden rain storm forced it to turn back.

The second day the same two helicopters were stripped of all non-essentials before making the morning flight to the scene of the salvage efforts. Capt. Dave Reid replaced Capt. Godbold as pilot of the second 'copter and Bogue, who finished his radio work the first day, and Capt. Riordan stayed behind. Otherwise the crew was the same.

Before taking off on the half-hour flight, the men estimated they would be able to strip the wreck until the hull weighed about 1900 pounds. The weight of the engine was figured at 1400 pounds. These figures were later revised to 1500 and 800 pounds.

Maj. Neuss and Capt. Reid flew directly to the wreck, by-passing the island, and landed the crew and equipment. Then they left for Lejune to bring more marsh mats for building a solid walk around the wreck. One load of mats was used to replace the swamp board landing platform, but this new strip was never used.

Higgins, as the smallest man in the crew, was sent into the tail cone to disconnect the control cables and antenna lines and to loosen the bolts holding the broken cone to the fuselage. While working in the cramped quarters, he became the project's lone casualty, cutting his hand on the cables.

Willis and Rankin went directly to the top of the wreck where they began to detach the main rotor. Comer replaced the lieutenant there after he removed the tail boom. The nose cowling was opened and Shadle started work on the engine.

The captain came in for a load of doors, windows and other detached parts, and the call was sent over to the island for the major to come after the rotor head. He called back instructions to remove the push-pull rods from the rotor first so they wouldn't be damaged by landing on the sand of the island.

At 10:30, exactly an hour after the crew landed at the wreck, the major took off in "Twelve" which was rigged with a hook and cable attachment under the fuselage. Willis and Comer stood on the wreck and, as the major hovered above, they fastened the hook to a ring on the rotor head.

The big eggbeater rose in the air, lifting the head so neatly that it didn't strip a thread on the loosened connection of the head and transmission. The head was flown to the island where the major laid it in a wire equipment basket, which was then hooked under the captain's helicopter for the flight back to Cherry Point.

The tide was rising, hampering the work of the crew, and Cowan expressed his doubt regarding the ability of a helicopter to lift the fuselage with its "bathtub" filled with water. Despite the doubt, the men kept at their tasks, concentrating on removing all connections between the transmission and the fuselage.

Higgins was on top of the hull and disconnected the shaft from the transmission. It was one of the pieces loaded in the major's 'copter on its next flight to the strip. The tail cone, loosened by the sergeant, finally broke loose and fell into the water.

The engine cowlings were taken off and Higgins went to work on the engine. Rankin suggested that they take off the carburetor, so the sergeant knelt on his hands and knees in the mud and water to loosen the oil line to get at it. He was soon covered with sticky oil.

Higgins and Rankin, the duo who provided most of the laughs for the crew, finally joined forces to remove the carburetor. They took care not to set it down where the salt water would reach it, but accidentally tilted it and watched a gallon of water pour from the inside. After that they worried but little over where it was placed.

Lunch time was drawing near and the hungry workers were beginning to worry over the failure of Capt. Reid to return with the promised chow. Higgins ventured an opinion that he could picture "The Colonel," back at the base eating a tender T-bone steak. Just then another flying windmill landed on the strip with "The Colonel," O. A. Chambers, at the controls.

The colonel picked up a load of gear, flew it back to the island, and then came back to take Comer, Higgins and Willis to the island. They loaded the part of the cone which had not been broken and took it along.

Col. Chambers then shifted from his "Seven" to "Twelve" and came over the wreck to pick up the 350-pound transmission. Shadle hooked it on and then made a mighty leap from the hull to the mud to get free from the powerful pull of the rotor blades as the 'copter lifted the transmission and carried it to the island where the three sergeants guided it onto a small wooden platform to keep it out of the sand.

The chow plane was sighted as the colonel returned to "Seven" to fly a load of parts back to the base. The men still on the mud flat were flown to the island for a quick meal of sandwiches, doughnuts, milk and coffee and a discussion of the plans for the afternoon activity.

The return to the wreck, by now stripped so that it hardly resembled a whirlybird, was made in two quick flights by the major, who didn't land but merely hovered while the crew jumped to the marsh below.

The first job for the afternoon was removing the instrument panel from the cabin. Comer was busy cutting wires to free the panel when he looked up from the maze of complicated wiring he was ripping apart and commented, "I've always wanted to do this."

The free wheeling shaft to the engine was loosened by Willis and was removed. Then all loose parts were taken from the hull to the life raft to clear the inside so that the floor boards could be taken out and the water could be bailed from the "bathtub" (which later proved unnecessary). Meanwhile, Rankin started digging away the mud from under the motor and the wheels.

Next the crew dropped the engine from the top to mats laid on the mud. The last four bolts holding the engine to the fuselage still couldn't be reached and another method was sought for getting at them.

A second life raft, still deflated and packed in a protective bag, was on hand and it was decided to try using it to lift the 'copter. After a concentrated effort, the raft was pulled under the fuselage and inflated. The crew was elated at the way it partially lifted the hull from the grasp of the sticky swamp. Then a long pipe was used for leverage and the wheels were pried from the holes they

PERCHED ATOP the wrecked helicopter in the swampland off coast of North Carolina, Sgt. Comer detaches the rotor head from the transmission. Another 'copter lifted it away

TWELVE, piloted by Maj. Neuss, lifts the 1500-pound hull of the wrecked helicopter from its muddy bed. Salvage by air of the 'copter saved taxpayers more than $100,000

had dug and were propped on swamp boards.

While oil, gas and water drained from the hull, the men removed the clutch and fan assembly from the engine. The same long pipe, which with a pair of tin snips and a six-pound sledge came to be known as the "equalizers" of the project, was used on a wrench for leverage while all hands held the fan in place as the assembly was detached.

With just one hard-to-get-at nut left to hold the engine to the body, Higgins adopted a contortionist's position to remove it. After a few rugged moments, he realized that he had been working on the wrong nut and surrendered the task to someone else while he settled down to relax with a smoke.

The major returned to the strip for the last load of small parts, while six men from the crew lifted the engine free from the hull. Then they started rigging the fuselage with ⅜-inch steel cable at the top, leaving a foot of slack to be grasped by the hook beneath the lifting 'copter.

Then the question arose about who would stay on the hull for the ticklish assignment of fastening the cable to the hook. Higgins volunteered with the remark, "I'll go, I'm not proud of myself."

The helicopter flown by the major moved in over the hull and the men below watched Higgins hook the cable and leap free. Then they spent tense moments as the ascension began and they saw that only one of the two fastening cables was secured to the hook. But Rankin saw that it was holding and gave the "go-ahead" sign. The major's 'copter easily hoisted the 1500-pound hull from its muddy bed and within 65 seconds deposited it on the island.

Maj. Neuss returned at once and hooked onto the engine which was also carried to the dry land. Exactly three minutes were required for moving both the hull and engine. The last lift was of the broken-off portion of the tail cone and it was carried, rear rotor blades swinging in the wind, from the water to be dropped with the other parts of the dismantled helicopter.

While part of the salvage crew began the wade back to the island, towing the two rafts and the windshield from the 'copter cockpit, the major made one last landing on the improvised landing strip to pick up the other crew members and the tools.

The salvage by air of a $185,000 helicopter had been finished by mid-afternoon.

Because of a heavy wind, Maj. Neuss decided against flying the parts back to Cherry Point, but he expressed confidence that it could be done easily in normal weather. Instead the parts were lifted again by 'copter and lined up along the clear water shore of the island to await the arrival of a crane on a barge which had been sent from the air station early that morning.

From the island the 'copter was carried by barge along the coast to Cherry Point where it was turned over to the Overhaul and Repair Division. Most of the helicopter proved salvageable, except for those parts broken by the impact of the crash or corroded by immersion in salt water. Preliminary estimates indicated that the two-day project had saved the taxpayers more than $100,000.

The experiment at air salvage had been a success and the crew of Marines established a pattern to be used for similar operations in the future.

Summerize Your DC-3

(*Continued from page 27*)

weather aids for an executive transport is 50 pounds of ice in the galley—liberally crushed over a case of Coke or any other hot-weather drink that happens to suit the executive passenger's fancy.

Executive pilots should be very sure that the cowl flaps are open for taxi and they should always keep a cautious eye on the cylinder-head temperatures during their take-off roll to make sure that the engines do not get so hot that they will commence to detonate. The head temperature red-line on an 1830-92 engine, for instance, is 260° C and considerable power loss will occur if the pilot slips up and lets the temperature go beyond that point.

Another change that some pilots have made for hot weather is to use 100 octane fuel in place of 91. This practice is not recommended since the carburetors should be completely readjusted to handle the higher octane fuel. Since 100 octane cannot be obtained at all fields, we feel that a carburetor set for 91 octane is the best all-around bet for nation-wide travel.

The back of the latest CAA maps devotes considerable space to hot-weather operation from the pilot's viewpoint. Since there are occasional pilots who never think to turn their maps over (not very many flying DC-3's since the executive pilots are a mighty reliable group as a whole) it might be in line here to quote from this CAA memo on the loss of aircraft performance during the hot weather months.

"Thin air reduces lift. You get thin air at high altitudes and in hot weather. The hotter the temperature, the thinner the air, the less the lift.

"Do you realize that Kansas City Airport with an elevation of 744 feet above sea level can have an effective elevation identical to Stapleton Field, Denver, at 5,325 feet above sea level, under conditions of extreme heat and low pressure?

"Do you realize that Brees Airport at Laramie, Wyoming, at 7,273 feet above sea level, can be above the safe operating altitude of your aircraft during hot weather? Note: the effective elevation of Brees Airport at 86° F, for example, is 10,250 feet!

"The rarefied air at higher altitude lowers the efficiency of engine and propeller, and lessens a plane's rate of climb. A typical lightplane has a maximum rate of climb at sea level of 420 feet per minute, whereas its maximum rate of climb at 5,000 feet altitude is only 225 feet per minute.

"This plane might be able to clear a 400-foot hill or factory stack located a few miles from a sea-level airport, but if the pilot tried it at 5,000 feet, he would smack right into the middle of the obstruction. Remember (. . . and this "remember" should be printed in red): Any increase in operating altitude (due to elevation or high temperature) greatly increases take-off and landing roll."

So when the temperature gets above the century mark on the ground, just make sure that there's always plenty of runway ahead of you on take-off. And don't forget those empty ice cream cartons for the passengers who might be bothered by rough air, because hot weather makes rougher trips, particularly at the lower levels where a DC-3 operates best.

Pilots Meet with CAA

(*Continued from page 35*)

Weather Bureau or pertinent Control Tower. Cockpit-observed weather is *not* considered valid in connection with instrument approaches. Also in connection with the subject of instrument approaches, all instrument approaches attempted when the weather is below 500 feet or one and one-half miles visibility, are reported to the appropriate Aviation Safety District Office by either the Tower concerned or the Air Route Traffic Control Center authorizing the approach.

Continuous Instrument Flight Plans.

Most executive pilots present seemed to be of the opinion that the scheduled air carriers were operating on continuous flight plans permitting stops enroute and therefore gaining a preference over other traffic, particularly in connection with instrument departures. It was brought out that *no* "continuous" flight plans are accepted from any operators. The scheduled air carriers refile their flight plans after arrival and before departure at each stop. The fact that they appear to move faster is because the flight plan is refiled by the local airline ground-station personnel. It makes no difference in the handling of a flight plan how far in advance the plan is filed since the plan cannot be placed on the ARTC control board until the pilot has indicated he is ready to start.

When a landing of short duration is contemplated, the pilot may refile his flight plan to the local Communications Station prior to his initial arrival over the local reporting position. These flight plans should be filed with the Communications Station and before switching over to approach control.

The airlines do not have any priority over any other traffic. The actual handling of their flight plans is identical with that which other pilots receive. Where the airline does have the advantage is that they have ground personnel to handle that phase and their own company communications system.

FUEL TANKS on wingtips will add range to new turbo-prop powered *Super Constellation*. First passenger-type ship to fly with tip tanks is this test *Super Connie*

Filing Flight Plans Directly With The Tower by Radio.

This is strongly discouraged by the CAA because it ties up radio frequencies which are urgently needed for the handling of aircraft already in operation and, if done on a large scale, would only serve to further slow down the receipt of clearances. In order to encourage pilots to file flight plans on the ground with Communications Station a new fast line for direct communications from the various service hangars on Lambert Field to the local Communications Station has been installed. This is intended to take the conversation off the radio channels. In connection with this subject, it was pointed out that CAA personnel are forbidden to file flight plans to the Tower by radio. At this point Mr. DeLany of the CAA outlined a procedure recently effected in the State of Colorado whereby VFR flight plans may be filed and closed at places where there are no CAA facilities through the Colorado State Highway Patrol. Although Colorado has very few CAA Communications Stations, it is now possible to fly anywhere within the state on a flight plan and encounter no more difficulty than a short toll phone call to a State Highway Patrolman to close the flight plan.

Broadcast Weather Reports.

The question as to why broadcast weather reports no longer contain all the information which they had prior to June 1950 was raised. Temperatures between 35° and 80°, dewpoint when the spread is more than 4°, and wind velocities of less than 12 mph are no longer included in the standard broadcasts. That information may be obtained, however, if the pilot, upon requesting the weather, states that he wants the *complete* sequence report. The CAA is interested in obtaining pilots' opinions of this new procedure and there may be a revison of the procedure depending upon what pilots think of it. (The pilots present were polled concerning the subject and were of the opinion that they want the complete weather report.)

Difficulties in Contacting Weather Bureau by Telephone.

It was established that pilots encountered long delays due to the Weather Bureau telephone being busy during periods of bad weather. Due to the numerous calls the Weather Bureau receives from the non-flying public inquiring as to temperature, whether it will rain or snow, etc., the pilots recommended that the local Weather Bureau attempt to obtain an unlisted telephone, the number of which to be given only to those persons in aviation. It was stated that among other cities, New Orleans, Philadelphia, Wichita, and Omaha, now have unlisted telephones, and the use of those numbers greatly expedites the obtaining of aviation weather. Mr. Bowie of the Weather Bureau advised that he would investigate the possibility of obtaining an unlisted telephone for the St. Louis Airport Weather Station.

Flight Advisory Weather Service.

The pilots highly commended Flight Advisory Weather Service. They expressed the opinion that it is a worthwhile and reliable service. It was suggested that FAWS be provided with telephone service so that the pilots might contact it without the necessity of going through the Weather Bureau. No

MODEL P-136 FRANKLIN is a new five-place amphibian designed and built in Genoa, Italy by the Piaggio Works. Featuring an exceptionally smooth design, the Franklin is powered by two 215-hp engines, has cruising speed of 130 mph

action was taken upon that suggestion.

Future Improvements to Landing Area at Lambert.

The Fred Weber Company has the contract to extend Runway 12-30 from its present length of 5100 feet to 7900 feet, and a new runway 17-35 of a 6,000 foot length and a 150-foot width. Related taxi strips are also included under this project. Plans for the new Administration Building are progressing satisfactorily.

Everything is ready for installation of surveillance radar with exception of the radar unit self. However, this unit should be installed and ready for operation about the first of July, 1952.

The outer marker of the ILS has been relocated, and recommissioned. There are no present plans for another instrument runway at Lambert Field.

Why Was the Expression "Cruise and Maintain" Eliminated from Clearances?

The word "cruise" was superfluous, the word "maintain" says all that is necessary.

Clearances Via VOR Range.

The question was raised as to why flights cleared on VOR, upon departing from the control of one center to another, are occasionally recleared "point to point." Why not clearances VOR all the way? It was determined that this does not pose a major problem with the pilots present. However, by way of explanation, this is a necessary evil of the transition period which we are now in with regard to VOR and low frequency ranges. At such time as the ultimate VOR program is completed, clearances will be issued all the way on VOR. At this time, however, VOR clearances are in conflict with LF airway clearances. There is conflict of right and left hand traffic and also difficulties are encountered when changes of altitude are necessary with aircraft in the same vicinity utilizing among them both types of ranges. In connection with changes of altitude the question was asked, "When given a clearance to descend well to the right, what traffic is to be expected?" ARTC is required, when issuing such clearance, in all cases to advise exactly what the traffic consists of.

Holding Patterns.

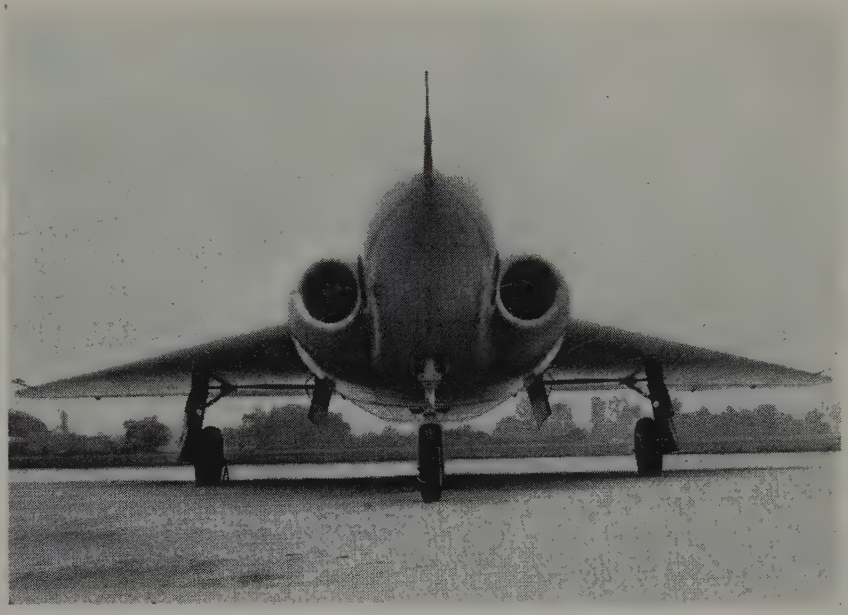
The pilots were polled as to their preference between one-minute and two-minute holding patterns. They indicated they prefer the one-minute pattern for anything other than a prolonged period of time.

Fabric-Covered Surfaces.

It was brought to the attention of all present that there had been numerous cases come to light recently of very poor fabric, particularly on control surfaces. All concerned were urged to request that samples be taken and tested at least during each annual inspection of the aircraft.

In closing the meeting, the CAA commended the executive pilot group upon its exceptional safety record. The panel expressed its appreciation for the opportunity to discuss mutual problems and assured the pilots every effort would be made to assist them. The pilots in attendance considered the meeting extremely worthwhile and plans are being made for similar meetings to be held periodically not only in St. Louis but in the other CAA regions.

Here's Looking At You!



Shades of Kitty Hawk, it is a long way back to 1903—as you can see from this front view of this Gloster G. A. 5. But old or new, if you are a regular reader of SKYWAYS, you're up to date on the world of aviation.

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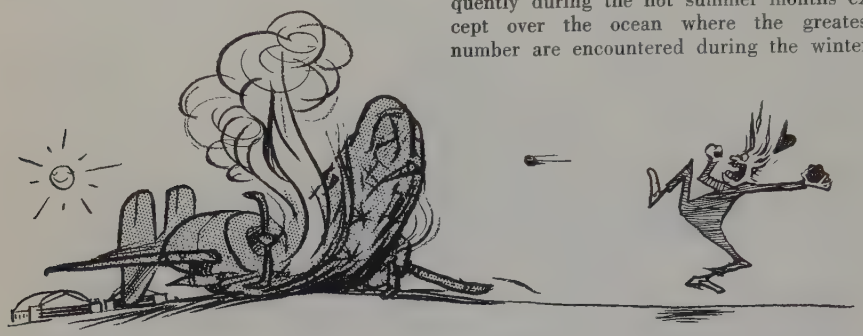
7-52

Dilbert

(*Continued from page 36*)

operation, an additional check can be made after landing.

Take That-and That—A few months ago a pilot contracted to fly an airplane to the West coast. The entire trip was just one headache after another for the pilot (believe it or not, not Dilbert).



First, there was considerable delay due to engine trouble—and more on the way. Then several delays enroute because of bad weather. On one landing a tire blew out and had to be replaced; plus wing tip repairs.

Finally, as he approached his destination, it happened again; the wheels wouldn't come down. He tried everything in the book to lower those wheels, but no luck. So he gave up and came in for a belly landing. Then, as the plane slithered along the ground, the final straw—it caught on fire!

By the time the crash truck arrived the plane was enveloped in smoke and flames. The crew was much relieved to see that the pilot had gotten clear. But when they looked again, they were glad the ambulance and doctor were right behind them. For there was the pilot, swearing a blue streak and vengefully throwing rocks at the blankety blank burning ship.

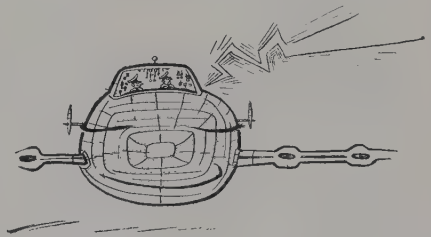
Bunner Vetter—Why all the fuss about staying out of thunderstorms? Investigation indicates there may be something to it, after all. Here are four good reasons: 1. Heavy rain, 2. Lightning, 3. Hail (usually), and 4. Terrific rising and descending air currents, often with a velocity of 10,000 feet per minute.

It is comparatively easy to recognize a thunderstorm; the most conspicuous characteristic is the distinctive swelling cumulus cloud which looks like a cauliflower along the sides. The top of a thunderstorm cloud is usually flat and, because of its distinctive shape, is called the "Anvil." The leading edge of the "Anvil" is almost always blown ahead of the main body of the thunderstorm, thus giving a good indication of the direction the storm is moving.

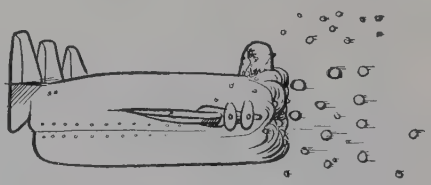
Thunderstorms are formed when warm, moist air is lifted into cold air, as on the windward side of a mountain range or by heating from below. They occur most frequently during the hot summer months except over the ocean where the greatest number are encountered during the winter.

The difference between an ordinary shower and a thunderstorm is one of intensity only.

In addition to the violent vertical air currents which may result in loss of control or structural failure, you are apt to encounter lightning and hail. Lightning is of little consequence in an all-metal, closed-cockpit plane. If the ship has an open cockpit or has a plastic or plywood fuselage, however, structural damage may result from lightning discharges.



Large hailstones may cause a great deal of damage to any type of aircraft. In some cases hail may even be thrown outside of the cloud and encountered there. As in any instability cloud, icing may be encountered in a thunderstorm above the freezing level.



Just in case you may be interested in how best to meet these problems, here are some flight precautions:

1. If at all possible, *fly around* thunderstorms.

2. If you have to go through and contact can be maintained, fly under the storm. Over land, remember that downdrafts and turbulence create a definite hazard. In flying underneath, the higher the flight level, the rougher the trip; if possible fly about one-third of the distance from the ground to the base of the cloud.

3. It may be possible to fly over the storm. But don't try this unless your plane has sufficient ceiling and is equipped with the necessary de-icing and oxygen equipment.

4. Cold front thunderstorms generally stretch too far to fly around. If you have to go through, fly between the storm centers.

5. If all other methods of avoiding the storm fail, and you gotta go, try and determine the direction of the storm and head in at right angles. Once you have started in, don't turn around because of turbulence, rain or hail, as you will have to fly through the same conditions twice, and you may get lost.

6. To avoid being temporarily blinded by lightning, turn on your cockpit lights and keep your eyes on some object in the cockpit.

7. If you enter the front of the storm, there will be updrafts, so go in *low;* if you enter the rear, there will be downdrafts, so go in *high.*

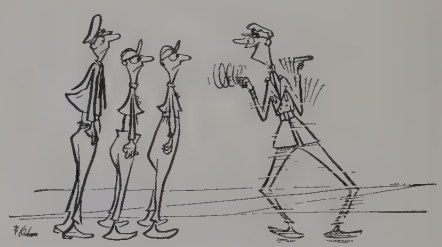
8. In flying through the storm, the top third will have the least verticle currents.

9. Never land at an airport when a thunderstorm is advancing because of strong, shifting winds. Wait until storm has passed.

10. If you intend to try high-level flight, get altitude before approaching the storm area, so you are on top of the cloud shelf around the storm, thus you can detect the storm line before selecting your course.

Slick Trick—Two mechs and a pilot had been spending the better part of the morning trying to start a balky engine. Then Dilbert came to their rescue. He pointed out that they had a 10,000-foot runway. If they would taxi at high speed and get their prop to windmill up to 600 rpm, the engine would start and they would still have plenty of room for take-off.

Then Dilbert was gone.



SETH'S SAFETY QUIZ

1. If you have to land with a dead stick, will your gliding distance be less than with the motor idling?

2. Due to "thin" air, landing speeds must be increased at altitude. How much increase per thousand feet must you allow on your airspeed indicator?

3. What type landings should always be made on glassy water?

ANSWERS

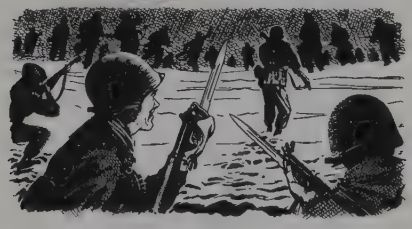
1. Less, of course—and be sure to allow for it.

2. None; it is actuated by the same air density which affects your airplane.

3. Power-stall landings because of inability to judge altitude accurately under these conditions.

Lieutenant Stanley T. Adams Medal of Honor

ONE BITING-COLD FEBRUARY NIGHT, Lieutenant Adams was on a bitterly contested hill near Sesim-ni, Korea. Out of the dark earth the silhouettes of some 150 Communist troops rose up against the skyline. Ordering fixed bay-



onets, the lieutenant, with only 13 men, leaped up and charged furiously against the overwhelming odds. He was knocked down by a bullet. At least three hand grenades actually bounced off his body before exploding nearby. But when Adams and his squad were through, there were only 50 Communists left on the hill—and they were dead.

"Nobody likes to kill," says Stanley Adams. "Nobody likes war. But today the surest way to invite a war is to be weak. You and I know that twice in the last ten years Americans have let their guard down. And the Philippine and Korean graveyards are filled with men who paid the price for it.

"Please don't make that tragic mistake again. Remember that in the world today, *peace is only for the strong*. Help make your country and your armed services stronger still—by buying more . . . and more . . . and more U. S. Defense Bonds. Put *your* bond-power behind *our* fire-power, *now*—and together we'll keep America at peace!"

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Peace is for the strong... Buy U. S. Defense Bonds now!

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GCA or ILS

(Continued from page 25)

pilot when he is above or below the beam and a second needle on the same indicator tells him whether he is right or left. In addition, flashing lights tell him how far he is from the touchdown area. The lights work automatically, actuated by radio marker beacons on the ground.

Watch the cross-pointer indicator; watch the blinking lights; monitor the airspeed; watch the altimeter and at the same time fly the airplane. Then, pray that you break out of the fog over the runway. That's ILS. The pilot's task is tense, weary. Small wonder he's in a sweat.

GCA takes away some of the load on the pilot. But it poses a psychological problem. He literally turns control of his airplane over to a guy on the ground. GCA utilizes two kinds of radar: (1) Surveillance radar or search radar which picks up the plane on a scope when the plane is 20 to 30 miles away; and (2) Approach radar which picks up the plane when it is six to eight miles away from the end of the runway. The pilot in the plane sees neither of these radarscopes. But controllers on the ground know exactly where he is relative to the proper position to make his approach and—very important—where he is relative to other aircraft in the vicinity. Using VHF (very high frequency which virtually eliminates static or storm interference), the ground controllers steer the pilot with oral instructions. The pilot is technically "in the hands" of a man on the ground until he breaks out over the runway, takes over and lands.

GCA will work. It has worked successfully thousands of times. It was the "heart" of the Berlin Airlift. Its success depends primarily on one factor—*the faith a pilot puts in the operator on the ground.* Its success also depends on how well the radar is working and, to some degree, on the weather. Certain types of weather, such as blowing snow or sand, driving rain or even fog with a make-up of large-size water droplets, have been known to "clutter up" the radarscopes so that operation was impossible.

Reactions are varied. Some pilots reason that the man on the ground is "in a better position than I am because he can see and I'm blind." Others crack: "I'm the only guy who can do anything about it. I want to run my airplane." Both are right. ILS control with GCA monitoring is considered by several organizations to be a good solution in that it gives a cross check on both systems and, in case one system fails, a second system is available on which to fall back.

The big question then is not whether ILS or GCA works. The answer is mechanical—they will work. The problem is to get pilots to accept new improvements. Something is being done about that, too. Developments are in progress which indicate the day is not too distant when the human touch and the human thought will be alert for "emergencies only." The rest will be automatic.

Out at the big Wright-Patterson Air Force base near Dayton, Ohio, a small group of pilots and engineers are straightening out the curly-tail of the question mark about blind landing systems. In time it will be an exclamation mark—blind landings, click, click, click, with the precision of a machine!

Charged with carrying out vitally important tests and development of new blind landing systems is the Air Force's "All-Weather Flying" gang, part of the Wright Air Development Center's Flight Test Division. The boys presently are engaged in tests of several new ILS and GCA systems which preview the day of automatic flight.

Automatic flight is not exactly new. One day in 1946, for instance, I climbed aboard a big C-54 airplane for a test demonstration. The pilot taxied the big ship out to the end of the runway. Then he sat back in the seat and folded his arms. A "push-button" brain took over. The pilot didn't touch a thing. Nevertheless, the engines revved up . . . the plane started to move along the runway, gained speed, was airborne. A light flashed on the instrument panel. The wheels came up. The plane climbed. Suddenly it leveled off. Another light flashed. The engines slowed down to cruising speed.

For a few minutes the plane flew level and true. Then it banked, made a turn. We were over Cincinnati. The ship took a new heading—for Indianapolis. True, the movement wasn't too smooth. It was a little jerky, like the movements of a robot. Over Indianapolis it made another turn. We were headed back to the field. Minutes later the plane started to descend. The flaps came out of the wing. The wheels let down. The next instant the wheels touched the runway. The pilot took over and taxied up to the hangar.

The fog was still so thick you couldn't see the big plane standing there when you were 50 feet away!

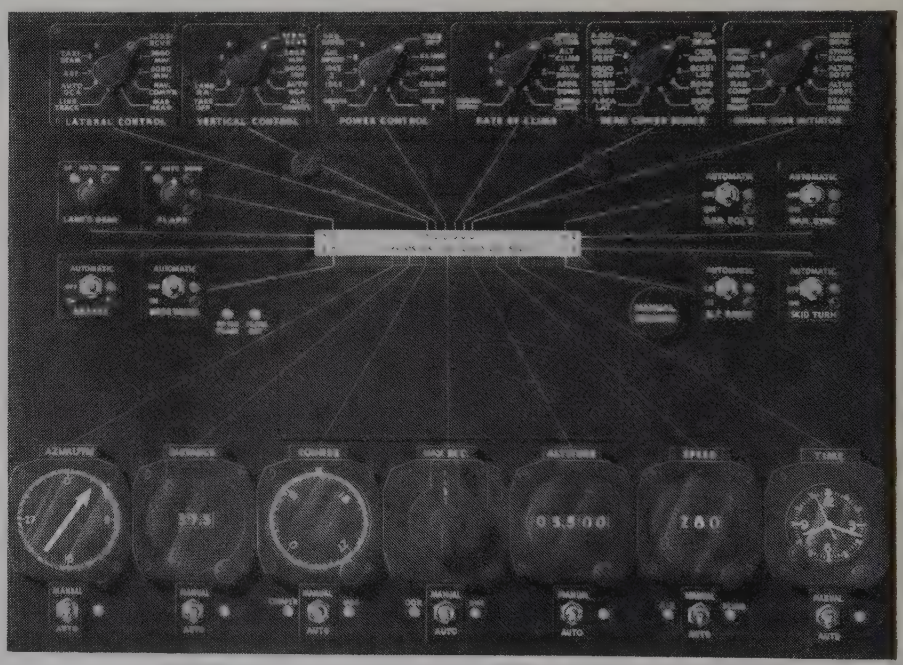
That was six years ago. Between then and now the All-Weather Flying group has worked many of the "bugs" out of their automatic airplane. The culmination of these developments will be centralized in a B-50 aircraft which is presently being instrumented for flight tests of combined automatic flight controls.

The complete automatic equipment planned for the B-50 will include automatic power control, automatic rate of climb and descent, automatic navigation, automatic approach and landing and automatic landing roll. In addition to the automaticity that I witnessed on that first automatic flight back in 1946, the B-50 will be taxied automatically to the proper runway for take-offs—probably under direction of a traffic controller—and it can be parked automatically the same way when it lands. The idea behind this new innovation being an aid to traffice control problems on the ground as well as in the air. It will also use new auto controls that make mechanical checks along its route, eliminate a lot of the en route navigation problems, fit it into a traffic pattern at its termination point and link it to the ILS or GCA landing systems which can bring it in automatically to the touchdown phase and then complete the landing.

"The whole operation," one of the All-Weather engineers explained, "centers around various pieces of equipment within the aircraft which are controlled by a master sequencing switch capable of reading flight information punched out on a roll of continuous tape."

They call it the "Player Piano Pilot."

One semi-official report describes it this way: "The aim of the equipment is to make the aircraft completely self-sufficient once it is properly set up for all phases of flight. The complexity of the system can be realized when one considers the automatic actuation of flaps, engine rpm, manifold pressure, automatic brakes, automatic landing gear actuation, automatic navigation for ground track (independent of varying winds) through computation of position, automatic attitude stability of the aircraft, plus automatic track stability of the navigation equipment, automatic sensing of altitudes throughout the flight, automatic interception and sensing of when to turn on to radio beams and sensing of airspeed for control of rate of descent on instrument low-approach sys-



PROPOSED PANEL for Master Sequence Selector looks like this. Master sequencing switch capable of reading flight information punched out on tape is called "Player Piano Pilot"

AUTOMATIC FLIGHT equipment has been tested on USAF C-54. This plane made automatic or "hands off" flight across Atlantic from Newfoundland to England several years ago

tems, automatic crab correction at touchdown, automatic speed sensing of wheels for non-skid auto braking, fail-safe devices and warning to pilot of the equipment malfunction."

All-Weather personnel are quick to point out that the combined equipment has never been tried operating together as a composite unit in one aircraft. But all components of the system have been separately tested—the engine controls in a B-29; attitude stability auto controls and track equipment in a B-50; auto navigation equipment, brakes and landing roll guidance in a C-54.

But automatic flight is only one phase of the work going on here. Right now evaluation tests are being run on several blind landing systems; Manual ILS, Manual GCA, Automatic ILS, Automatic GCA. They are testing Civil Aeronautics Authority ILS and the Air Force ILS. Also included are various higher radio frequency ILS systems.

It is difficult to pin any of the pilots down to specific opinions of the various systems, but one engineer ventured this comment as to results of some of the tests: "We have deduced in general that manual systems can be utilized with a 95 per cent expectation of success operating to limits of 200 plus feet and three-fourths of a mile visibility. Automatic GCA or automatic ILS would have a 95 per cent expectation of success when used down to visibility limits of 100 feet and three-eighths of a mile. It should also be noted that the most precise system that we measured (the 2600 megacycles ILS) allows operation down to 50 feet and one-eighth mile visibility. This comes very close to the goal of zero-zero landing."

He is quick to add that zero-zero landings (down to runway in zero-zero conditions) are not believed possible through refinement of present equipment. "This will require new techniques to provide a higher track accuracy and new methods of landing control," the engineer says.

Several such schemes are under development at the present time to provide complete automatic landing. They involve the use of absolute height measurement to provide an exponential series of tracks in the vertical and use of new methods of directional track control. This method uses a navigational reference of much higher precision than has been utilized before. Another means is use of highly experimental airborne equipment.

Meanwhile, one of the most interesting experiments is that being carried on with a new Automatic Precision Approach Radar, more commonly called Automatic GCA. The APAR system is different than any presently developed system. It is controlled by rectangular beam coordinates instead of the usual polar beam coordinates and it also employs control sensitivity which can be made to function during range to touchdown. A special "de-coder" in the airplane which links directly with its communications system translates the control signals and feeds to the autopilot.

Almost daily a C-47 aircraft equipped with APAR linked with the ANE-4 autopilot and its associated approach coupler is being used for numerous approaches under complete automatic control. They are also running tests with the approach coupler linked to the ILS system.

Heart of the automatic blind systems is the newly developed Approach Coupler. This "little black box" is the brain that takes the data from the auto GCA or ILS systems and feeds it into the automatic pilot which in turn controls the aircraft into proper attitude positions. It eliminates the ground-to-mind, mind-to-muscle-to-control technique of human flying and makes the whole process automatic. The pilot merely has to monitor things to see that the mechanical brain is working properly.

They are also testing an airborne radar beacon which permits the ground radar operator at the traffic control radar or the approach control radar to more positively identify the airplane and its location on the scopes. Reinforcement of the radar signal is almost a necessity for good radar operation in some types of weather.

Heart of the approach coupler is a high-grade amplifier which accepts the control signals via a receiver in the plane. It then takes the ILS or APAR signals and electronically transforms them into actuating impulses for the autopilot. Another amplifier converts the electronic signals into mechanical energy moving the controls of the plane.

It was pointed out that more than 600 airliners of our national and international airlines are presently equipped with the approach coupler to permit use of automatic ILS and will be able to use AGCA when it becomes available.

Tests with Radar Traffic Control run here have also been very encouraging. For instance, not long ago, All-Weather put 16 different types of aircraft into the skies and told them to "saturate our control area." There were Navy AD-I's Piper *Cubs*, a giant C-97, C-54's, C-47's, two F-86's, three F-80's and a B-50 in the skies over Patterson Field. Speed ranges of the various types spread from about 60 mph to 160 mph during approaches.

Using only one runway, GCA controllers accepted the aircraft from the Radar Air Traffic Control system and brought them in one after the other at one- and two-minute intervals. The performance was repeated several times to demonstrate with certainty how maximum use of a single runway could be maintained through the use of radar air traffic control feeding an approach system at regulated predetermined intervals. There was no "stacking." The planes followed each other down—once in the pattern—"like a bunch of elephants in a circus leading each other by trunk and tail."

But by far the most encouraging tests run by the All-Weather group was a program now completed. The test ran for two years from October 1946 until October 1948. It was in effect the operation of an all-weather airline. It proved beyond any doubt what could be done operating under instrument conditions.

The All-Weather Flying Section conducted flights between Clinton County Air Force base, a few miles south of Dayton, and Andrews Air Force Base, Maryland, each working day with an attempt to maintain a take-off and landing schedule of plus or minus one minute!

Here's the official report:

Take-off at origin was 0900 hours with landing at Andrews scheduled for 1100; take-off at Andrews was scheduled at 1300 with landing at Clinton County at 1500.

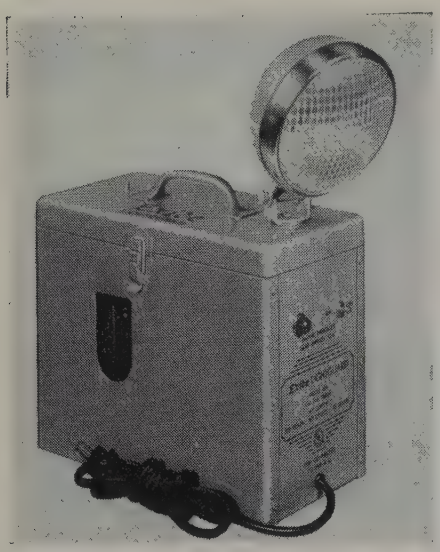
During these two years of operation, no trips were cancelled because of weather, with approximately 95 per cent departures and arrivals taking place within the one-minute tolerance.

One of the pilots said: "I needn't try to describe some of the weather conditions that we found on those daily trips, but we were exposed to a cross-section of weather where we found our share of thunderstorms, ice and sleet storms, extreme turbulence, heavy rain and heavy snow; six landings were made during the whole operation—with *no ceiling and no visibility!*"

There were over 50 landings accomplished counting both terminals, with less than 50 feet of ceiling and less than one-eighth of a mile visibility!

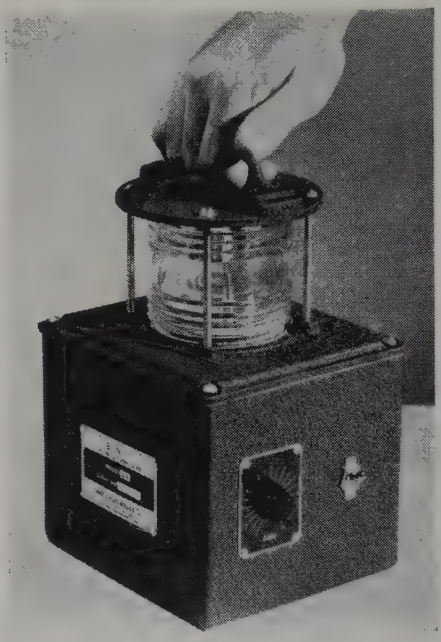
Blind flight has progressed since Jimmy Doolittle made that first experiment.

NEW AERO PRODUCTS



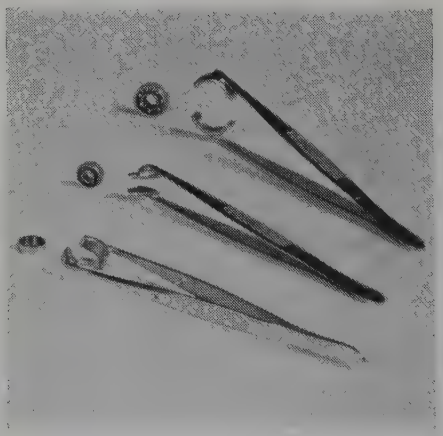
Blinky (*below*) is a lightweight, portable electronic signal flasher, with no moving parts or filaments to burn out. A low-cost flasher of cold cathode tube design, it emits a sharp brilliant flash of light that is clearly visible for a mile. The flasher utilizes a set of three standard 90-volt batteries in series. An outside knob controls number of flashes per minute. It weighs 8½ pounds, measures 6 x 6½ x 10 inches. Haledy Electronics Co., New York 5, New York.

Exide Lightguard (*above*) is a portable emergency lighting unit with a single sealed beam floodlight. The unit is always plugged into an outlet, which keeps its battery charged. In case of interruption of normal current, a magnetic switch automatically connects floodlight to the battery, thus light is continuous when unit is turned on. When normal power is restored, a relay turns off floodlight. It will illuminate 4,000 sq. ft. Electric Storage Battery Co., Philadelphia, Pa.

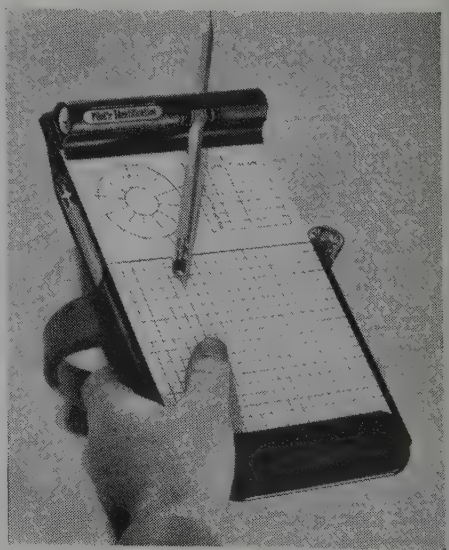


Chronograph (*above*) features "window" that shows date of the month. In addition to being a stopwatch, it acts as a telemeter and tachometer. It has precision-made imported Swiss jeweled movement, two-button "stop" and "start," radium dial, red sweep-second hand, expansion wristband. Watch costs about $10.00, has one-year guarantee; comes with How-to-use instructions plus Lifetime Service Certificate. For more information, write Buyer's Guild, Woodbridge, N. J.

Controlled-Flo Paint Striper (*below*) is a gravity-fed machine which requires no power unit. It will lay down single line or dual lines; has no hose to blow out, no jets to clean, no pressure tank to worry about, no brush or felt band to maintain or replace. The all-metal, sled-type spreader accommodates striping or zone paint of any standard make. It is well suited to line air strips, etc. Further information is available from Universal Yonkers Corp., Yonkers, N. Y.



Pilot Knee Board (*below*) is equipped with two-pencil storage compartment, coil spring pencil rest and built-in pencil sharpener. Chart cards are held in place by upper and lower spring clip. Board is made of solid black molded non-specular material. Weighs 9 ounces, but is strong, sturdy and durable. Adjustable quick-release strap holds board securely to leg. Costs $4.95, includes two pencils, 25 chart cards. Made by Semco Research Company of Inglewood, Calif.



Ball Bearing Tools (*above*) for handling instrument ball bearings during inspection, cleaning and relubricating operations have been developed. These tools are essentially special tweezers for use on bearings having bores from 3/32 to ½ inch, and are furnished in two models: one for gripping bearing by the inside race, the other for the outer race. Use of these tools will help avoid corrosive effects of fingers when handling bearings. The Baker Company, Maplewood, Maine.

Business Bonanza

(*Continued from page 23*)

Station calls me." I was beginning to understand the rapid growth of Soderstrom Enterprises. The man is as efficient as a Mark IV.

Supplying butane and propane for 2,000 customers in and around Indio—homes, restaurants, night clubs, etc.—the Indio Gas Co. is a key establishment in the lives of a good many people. One winter, soon after Chuck acquired his *Bonanza*, the huge truck-and-trailer rig which hauls the bulk gas from Torrance broke down near Beaumont, some 100 miles from Indio.

Gas supplies in Indio were running low and Jeff knew that if spare parts for the truck had to be ground-hauled from Los Angeles he could not avert a total shutdown. He got on the telephone and called Chuck Soderstrom.

In a matter of minutes, Chuck had the spare parts in his *Bonanza* and was on the way to Indio. There he picked up Jeff and ferried his load to Beaumont. Before night, the crucial butane was in Indio and not a single customer failed to receive his day's delivery.

After a tour of the gas plant, during which time Chuck's quick mind seemed to soak up figures, procedures and pertinent data, we had an early luncheon and were on our way back to the airport. En route, Chuck took time to stop at a farm-machinery distributor for a look-see. "I've got five acres of date land down here that I want to develop in my spare time," he said. "Might come down on week-ends and do my own farming."

By 12:30 we were off for Brawley, some 20 miles from the Mexican border. This leg took us past the famous Salton Sea, American counterpart of the Dead Sea and a fast-growing commercial and resort area. Chuck pointed to the peaks on the other side of the water. "Had one of my closest squeaks along here one day," he said. "Thunderstorms developed all along my route and I had to fly right down the center of the Sea. One storm on either side of me. Sometimes I thought I could reach out and touch the lightning."

Letting down again near Brawley, we flew over some of the most beautiful patch-work agricultural communities in America. This was the Imperial Valley, vegetable garden of Los Angeles.

Over Brawley, head-office for Chuck's drinking water activities, we had a different way of summoning airport transportation. Chuck did a 360 above a square, white building, smack in the center of town. Then he headed for the airport.

Again, just as we were parking, up drove a car. This time it was Marion Willard, top man for the Triple "A" Water Co. Marion, a transplanted Missourian, loaded us into his automobile and away we went toward town.

Native water in the South desert part of California is poor for drinking. Even imported Colorado River water runs as high as 21-23 grains of hardness. So when Chuck came into a good water well on some of his Indio properties, he took over the Triple "A", 30-year-old thirst-quenching pioneer of the Brawley area. With typical astuteness, Chuck has carefully been buying up defunct or disinterested competitors. And possessed of his own supply at comparatively near-by Indio, he now stands as No. 1 water man of the region. Through plants at El Centro, Yuma and Mexicali, in addition to Brawley, Chuck's Triple "A" unparches the throats of some 4500 customers and their families.

Here, as at Indio, Chuck made some whirlwind inspections and calculations and we were off. By 3:30 P.M., we were on course for Torrance and home.

Instead of re-tracing his route over Indio, Chuck makes the return jaunt direct. This called for an altitude of 7,000 feet to clear the mountain barrier. Chuck never crosses a mountain range without sufficient altitude to glide to a safe landing. And he knows where these are. Several times I tried to surprise him. "All right, Chuck, your engine just conked out. Where you going to land?"

And he was never without an answer. At any given moment, he could point to the nearest airport or strip. And when these were lacking, he had a good, straight road picked out. About a year ago, just to prove it was practical, he landed his *Bonanza* on a dirt road near a desert resort and taxied up to the front door.

Beneath us, the lights of Long Beach began to twinkle. At 4:45 P.M., we were touching down at Torrance, three air-hours, some 450 miles and 23 gallons of gasoline consumed since we had left that morning. But Soderstrom had one final trick for the day.

After parking the *Bonanza* in the hangar, he backed up his car to the nose of the airplane. There, in the turtleback, he had a tankful of aviation gasoline. Hauling out a little hand-operated pump he made himself, he proceeded to fill up his wing tanks. He looked at me with a twinkle in his eye and began counting the rotations of the pump handle. The guy even knows how many revolutions it takes to fill his tanks. I couldn't help but admire his foresight. Besides prolonging the life of his rubber tanks, this procedure helps eliminate dangerous vapors and keeps the plane ready for instant take-off.

Chuck estimates that his *Bonanza* costs him $12 to $15 per hour to operate. And that includes everything—insurance, maintenance, the works. By utilizing his airplane to tie together the scattered elements of his business, he has use of the *Bonanza* for pleasure trips. He thinks nothing of piling his family aboard for a hop to San Francisco, Seattle, Houston or New York. In plain dollars and cents economics, he figures that his *Bonanza* beats auto travel every way for his San-Pedro-desert travels. "Without my plane," he says, "I just couldn't run my gas and water businesses anymore. It would be out of the question.

"And besides that, it's darned convenient," he says. "Can't beat breakfast and dinner at home with a full day's work and over 450 miles in between."

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(Continued on page 60)

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(Continued from page 59)

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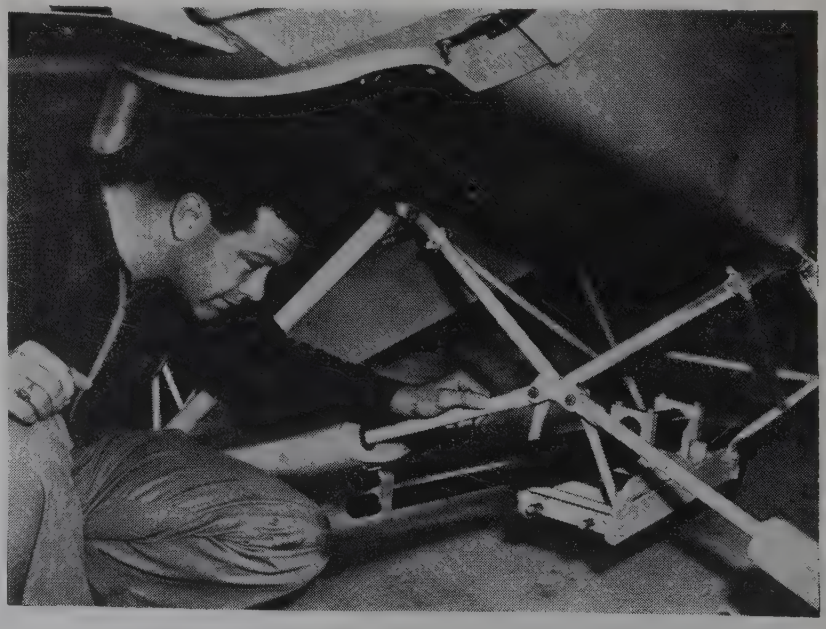
Ranch Cub

ARMED with automatic shotgun for shooting predatory birds, and carrying a public address system for directing cowboys on the ground, this Piper *Super Cub* is owned by Rancher Bob Masterson, of Paducah, Texas. Shotgun has proved extremely effective in shooting eagles which prey on small animals, and coyotes. With the sound system, Mr. Masterson can call down instructions to his men on the ground, greatly facilitating round-up operations and locating strays. Both installations were made by Jack Brink, shown *(below)* inspecting the gun.

SHOTGUN is mounted in landing gear Vee, holds 12 rounds and fires below prop



Computers Ready for CAA Tests

CAA receives computing pictorial indicators for flight evaluation

The last and most elaborate of the three CAA pictorial computer developments was unveiled recently before a handful of reporters at a Brooklyn press show.

This new entry for the computer evaluation tests is the first of the five units which Arma Corp., subsidiary of American Bosch Corp., has contracted to build for the CAA. It marks Arma's first commercial venture into the Aeronautical equipment field.

The Arma computer projects a 10-inch map onto a translucent screen mounted on the cockpit instrument panel. A "bug" marks the position of the plane as the flight progresses across the map.

Two other makes of computers developed for CAA are by Aero Electronics Co. and Sperry Gyroscope Co. (*Navicom,* May 1952). Each of the three companies is producing five units, most of which have been delivered to CAA for flight installation.

Purpose ▶ These computers mark another step towards fulfilling what navigators, pilots, mariners, and Army reconnaissance crews have dreamed of for years—automatic plotting of position on a map by means of a bug which traces your progress on the map and always tells at a glance where you are. Odographs and similar automatic plotters invented in the past saw no practical application for lack of a suitable position-finding system. But aviation will have VOR and DME to make use of the CAA computers possible.

In addition to showing position, some of the CAA computers will record track, indicate heading, and one includes a course-line computer which can tie into a flight director or automatic pilot.

Five Models ▶ CAA computer developments include:

Aero Electronics "portable lap" model, simplest and lightest of all, is designed to be held in pilot's lap during use. (All the others mount on the instrument panel.) It simply indicates the plane's present position. But position can also be recorded on the map if the pilot uses a pencil.

Sperry "Model A" uses an electric stylus which automatically draws plane's track on map by means of a dry facsimile process.

Sperry "Model B" is like model A but also indicates plane's heading on stylus and includes a course-line computer.

Arma "single-reticle model" projects maps from 35-mm film instead of using full-size paper maps. Turning a knob selects desired map from 100-foot roll and tunes in corresponding OBD station in one operation. Roll holds 700 maps. Bug which indicates airplane's position and heading is the shadow of a reticle projected onto the screen.

Arma "two-reticle model" adds another reticle which shows range and bearing from plane to any point on the chart.

Common Factors ▶ All the computers consist of two units: an indicator or display unit which does the plotting, and an amplifier which converts VOR and DME signals to the power levels necessary to operate the indicator. All map sizes as seen by pilot are 10 inches in diameter. Each computer will operate from standard OBD equipment and requires inputs of power, VOR bearing, and DME distance.

Basic CAA specifications allow the followng maximum errors in the computers: bearing ±0.5°, distance ±0.4 nautical miles, and heading ±7°. Laboratory tests show that the units exceed these requirements. However, final accuracies are yet to be determined.

Charts ▶ Maps are experimental charts prepared by U. S. Coast and Geodetic Survey. Four scales are used (all miles are nautical;)

1:2,000,000 DF or route charts, 274 miles diameter, 27.4 mi./in.

1:1,000,000 WAC or flight charts, 137 miles diameter, 13.7 mi./in.

1:500,000 sectional charts, 69 miles diameter, 6.9 mi/in.

1:250,000 local and approach charts, 34 miles diameter, 3.4 mi./in.

The OBD station is located in the center of each chart. An azimuth circle around the perimeter shows bearing from the station. Distance ticks are printed along 30° radials at 5, 10, 20, or 40-mile intervals, depending upon the scale of the chart. Charts are printed in black on white and are patterned after the new high- (*Continued on page 62*)

SPERRY MODEL B pictorial computer uses an electric stylus which automatically draws plane's track on map. It also indicates heading and includes course-line computer

Pictorial Computers Now Ready for CAA Evaluation

(*Continued from page 61*)

speed navigation charts which show only essential information.

For Evaluation ▶ None of the computers can be considered final designs. All three makes are still purely experimental developments sponsored by CAA under an ANDB program to devise the best means for flying OBD navigation aids. What ultimate computer designs will look like and do is yet to be determined. CAA tests which will compare the usefulness of each experimental type are the first steps toward finding what basic features are necessary or valuable to the pilot.

Why Computers ▶ Although the new OBD navigation devices are map indicators which show the airplane's present position over terrain, they are called "pictorial computers" by CAA. Reason for this designation is that any instrument which automatically plots present position on a map is in effect a graphic computer. They are "pictorial" because they visualize VOR, DME, and track information for the pilot. They are also computers because by showing the pilot where he is and which way he is flying, they indicate the direct course necessary to fly to a desired destination, even if the course does not follow a radial or a circle of the OBD coordinates.

Without a computer, pilots can fly only radials or circles around an OBD station with present instrumentation. An additional device is necessary in order to fly a course line that is offset from the station. Course-line computers devised in recent years for the OBD system have been for this purpose. The new pictorial computers take care of this problem as well as making OBD information easier to understand for the pilot.

Arma Features ▶ Arma cites the following as the principal features for its projection computer:

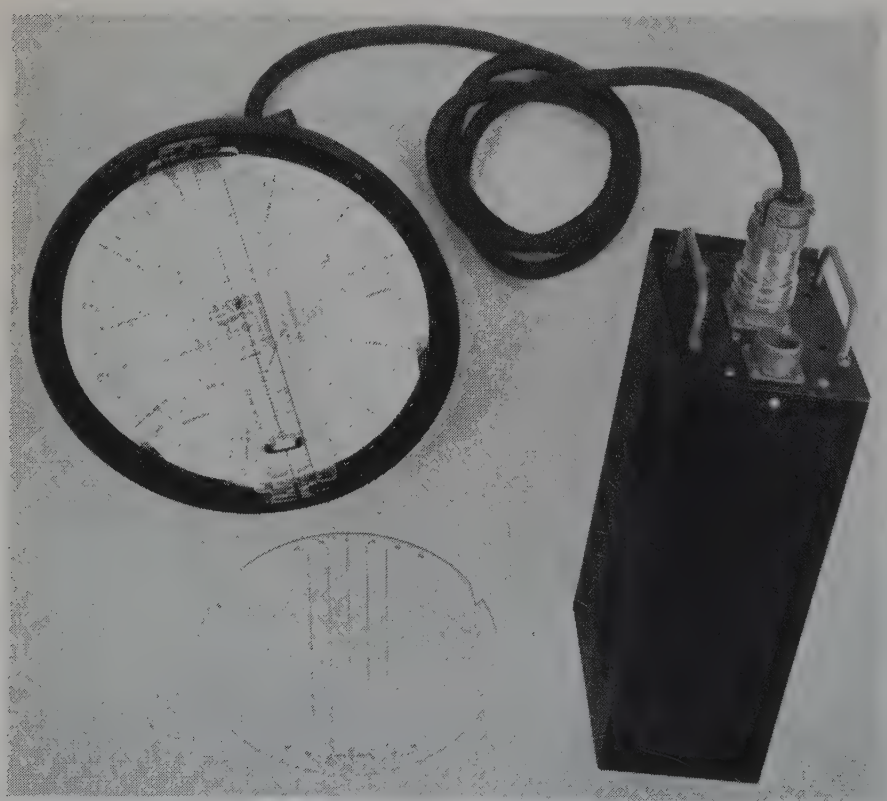
Operation is completely automatic except for selection of charts and certain initial adjustments.

DME and VOR equipment is automatically tuned to correct station and chart scales are automatically changed when a new chart is selected.

The computer indication provides range and bearing from the airplane to all points on the chart. (This applies only to the two-reticle model.)

The bug consists of a symbolic airplane with a heading indicating line which extends well beyond the nose of the airplane, far enough so that turning the airplane will place the heading line over any point on the chart.

How It Works ▶ Arma's computer works similar to a slide projector. Light from the projection lamp is collimated, passed through the two reticles, and then through the chart film which is projected on a beaded screen. Shadows cast by the reticles show up as a symbolic airplane with heading and range-bearing lines on the screen.



AERO ELECTRONICS portable model pictorial computer is small enough to be held on the pilot's lap. It simply indicates aircraft position; pilot can mark position on a map

The bug reticle is translated over the chart image by servos actuated by DME and VOR data. As the plane flies through the station area, the servos move the reticle so the bug's position on the map will represent the plane's position over the terrain.

The bug reticle is also rotated according to the plane's heading. This is done by a servo actuated by Gyrosyn Compass data.

A second reticle contains range and bearing coordinates for showing the location of any point with respect to the airplane. This reticle moves around the chart with the bug reticle. However, it does not rotate with heading.

Chart Selection ▶ Charts are selected by turning a handle on the face of the display unit. This slewing handle controls a motor which drives the film roll. Turning the handle further make the motor run faster until the limit of 10 charts a second is reached. The direction on the handle, left or right, controls the direction of the film roll. The control permits the pilot to run the film slowly enough to read the names of the charts. Releasing the handle causes the selected chart to center itself in the projector.

Charts are arranged in route sequence on the film roll so that the next chart needed is usually the next one on the roll.

Code holes in the film cause the OBD equipment to tune automatically to the chart station whenever a new chart is selected. This is accomplished by a series of contact fingers which slide over the holes. The arrangement of the holes determines which fingers make contact in much the same way as a perforated telegraph tape does.

Other Arma Details ▶ A brightness control is necessary to adjust the intensity of the projector lamp. Considerable range of adjustment is needed to cover both night flying conditions and day flying with sunlight in the cockpit.

The Arma indicator also contains a spare projector lamp arranged for quick changing when failure occurs.

The projection screen is covered with a prism lens which divides the light intensity in three directions, one beam to either side for pilot and copilot, and a third beam directed down the center of the cockpit.

The display unit is about 13 inches x 7½ inches x 17½ inches except for blisters protruding at front and rear of the unit. Weight is about 16 pounds. Weight and dimensions do not include shock mount and is the size of a standard S-2 chassis and cover.

Sperry Computer ▶ The Sperry unit uses a paper map as does the Aero Electronics computer. The bug is a stylus mounted on the end of a plastic arm and consists of a small electric thermal element which draws the plane's track

on the map by a facsimile process.

Operation of the Model A computer involves inserting the map and tuning to the OBD station and the map scale. Then the computer is ready to fly.

Maps are self indexing as on the Aero Electronic unit and changing them is something like turning a phonograph record. When the pilot opens the window on the indicator, the stylus automatically moves out of the way. Then it is simply a matter of lifting out one map and inserting another.

The pilot has a choice, having the stylus trace a track or not. A switch on the unit turns this function on or off.

Model B ▶ The second Sperry model includes a course-line computer which calculates the plane's distance off course and the distance to go to a destination. The right-left deviation and distance to go are displayed on separate indicators in the cockpit.

Right-left deviation signals can operate an automatic pilot and cause the plane to follow the course automatically. The signals can also be fed to a flight director. Distance-to-go information is a future provision which will be useful in traffic control and providing ETA checks. The model B can also be operated without the course-line computer function.

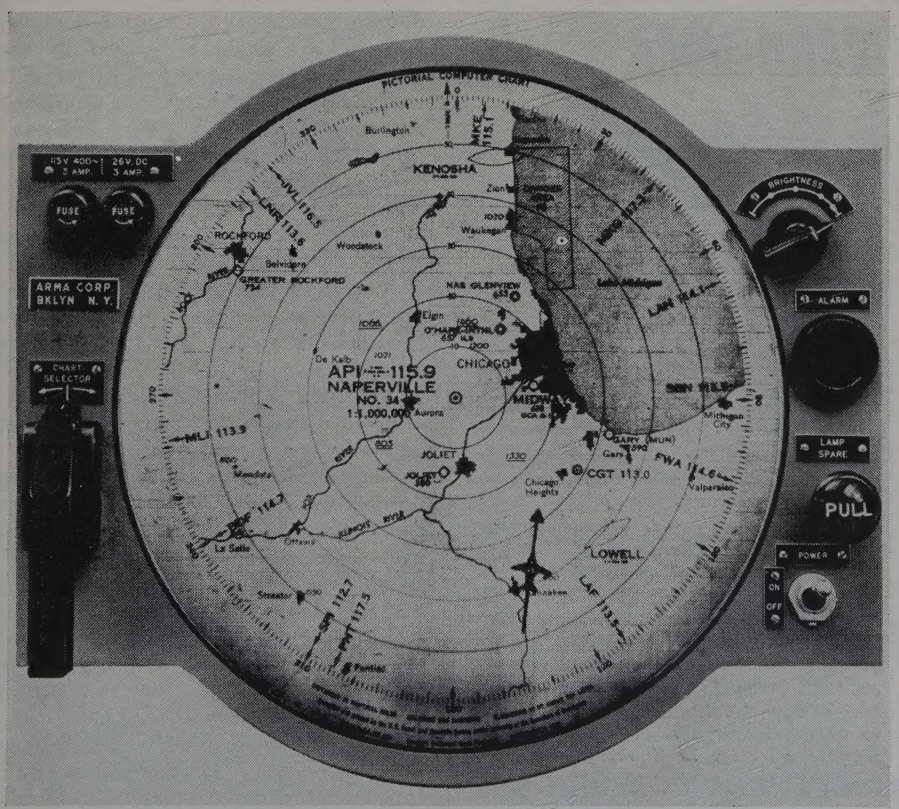
Operation of the Model B involves some preparation if the course-line computer is used. To use the computer, the direction of the course and the OBD coordinates of the destination must be known. This data is contained on the chart. If desired, the course line can be drawn directly on the chart, as a check on the data calculation.

Setting up the computer involves inserting the chart, as in the Model A, then rotating the chart until the course line is vertical. This puts in the direction of the course. Bearing and distance of the destination are then set in on the two dials in the upper right-hand corner of the panel and the computer is ready.

The Model B computer functions exactly as the Model A, but with the addition of heading indication on the stylus and the course data calculated by the course-line computer. Heading is provided by a steel arrow, about 5/8 inch long, pivoted on top of the stylus. The arrow is actuated by the Gyrosyn Compass.

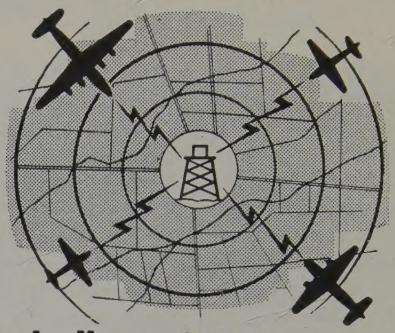
Course-line Accuracy ▶ Aside from being able to feed an automatic pilot, the principal advantage of the course-line computer is the ability to fly courses more accurately on large-scale charts. Full-scale deflection on the course-deviation meter is about four miles. Equivalent deviations of the bug on the four sizes of charts are 1.15, 0.58, 0.29, and 0.15 inches. Although flying by the stylus would be accurate enough on an approach chart, the deviation meter makes flying accurate courses on a DF or route chart much easier. Enroute accuracies will become more necessary as parallel airways are developed on the OBD system.

Sperry Details ▶ Both Sperry models are about 12 (*Continued on page 64*)



ARMA projection model pictorial computer stores 700 maps on 100-foot rolls of 35-mm film. Pilot uses knob to select desired map and tunes in the corresponding OBD station

OMNI's for ALL



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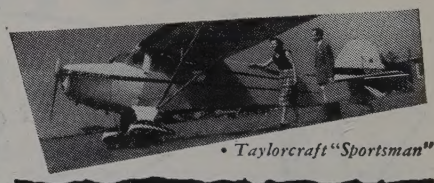

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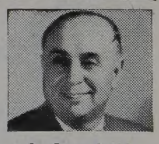

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Pictorial Computers Now Ready for CAA Evaluation

(*Continued from page 63*)

inches x 15 inches x 9 inches. Model A weighs 15 pounds and Model B weighs 23 pounds. The amplifier is an S-2 chassis as is the Arma and weighs about 12 pounds for model A indicator and 16 pounds for model B.

Accuracy Comparisons ▶ Basic CAA specifications call for similar accuracies in all three makes of computers. Performance-wise, all three seem to be comparable in accuracy except for heading indication. Although errors of ±7° are allowed in the development specs, the Sperry and Arma units do better. Sperry shows about ±5° in static tests and may do better in flight because of vibration. However the error is too short to permit approaching compass accuracies. Arma's long heading line permits reading to great accuracies and they expect to get ±1° error at the most.

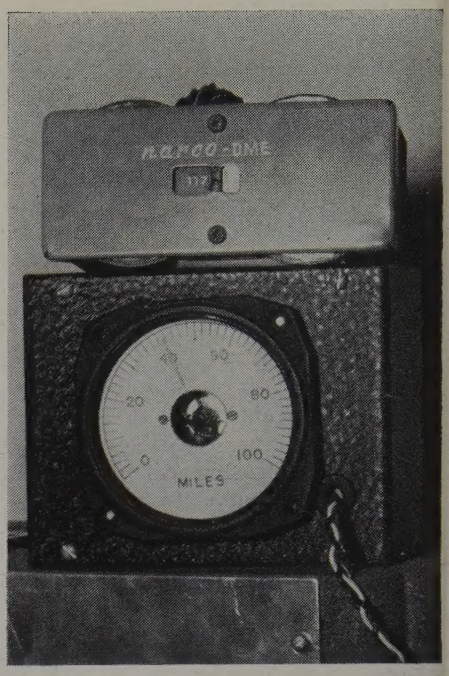
Other Developments ▶ The CAA pictorial computers will not be the first to be put in airplanes and flown successfully. Similar indicators have been developed for the Decca system, and for Shoran surveying in Australia, and by the Air Force for other types of OBD systems. Engineers of these predict interesting extensions in computer designs.

NARCO Develops Moderate Priced Lightplane DME

Distance-Measuring equipment will soon be made available to business and private pilots in the form of a moderately priced unit that is expected to go into mass production sometime next year. The instrument was demonstrated recently by NARCO at Ambler, Penn., using an electronic mock-up to simulate DME problems.

This light-weight DME which some are calling the "poor man's DME" weighs half as much as larger models—only 25 pounds. First models will be delivered to the CAA this fall.

Operation ▶ Operation is extremely simple. Distances from OBD stations are read directly and continuously on a three-inch indicator mounted on the plane's instrument panel. The control head consists of a small box with a window type dial and two thumb wheels for selecting the desired OBD station. The bulk of the instrument is contained in a separate unit about the size of a shoe box that can be tucked away in the baggage compartment of the plane.



NARCO DME weighs only 25 pounds. Distances from OBD stations are read from indicator

To operate the instrument, the pilot simply sets the dial on the control head to the VHF frequency of the omni station. This automatically tunes the DME to the UHF frequency required for that station. Then distance in miles is indicated directly on the dial on his instrument panel.

One particularly interesting feature of the DME unit is the use of an electronic memory system for providing a continuous reading on the indicator despite momentary interruptions of signal path as might be caused by the plane's wing coming between the OBD station on the ground and the three-inch antenna on the plane. This "holding" process lasts for about 15 seconds, which is more than ample for most cases.

By way of review, it might be remembered that the circuitry involved in the DME is similar to that used in radar, or more closely, in IFF equipment. The plane transmits a pulse of energy that is picked up at the OBD station which in turn sends out a pulse that the DME in the plane picks up. Distance is determined by timing the interval between outgoing and incoming pulses.

To eliminate any confusion when a number of planes are using the facilities of a single OBD station, the repetition rate of the pulses at each airborne installation is varied electronically. In this way the plane is ensured that the pulses it receives from the OBD station are those instigated by its own transmitter pulses. Capacity of any one OBD station for DME is well over 100 planes.

The frequencies used by DME have the advantage of freedom from static interference and tropospheric conditions, but as in the case of VHF, the usable range is limited to line-of-sight.

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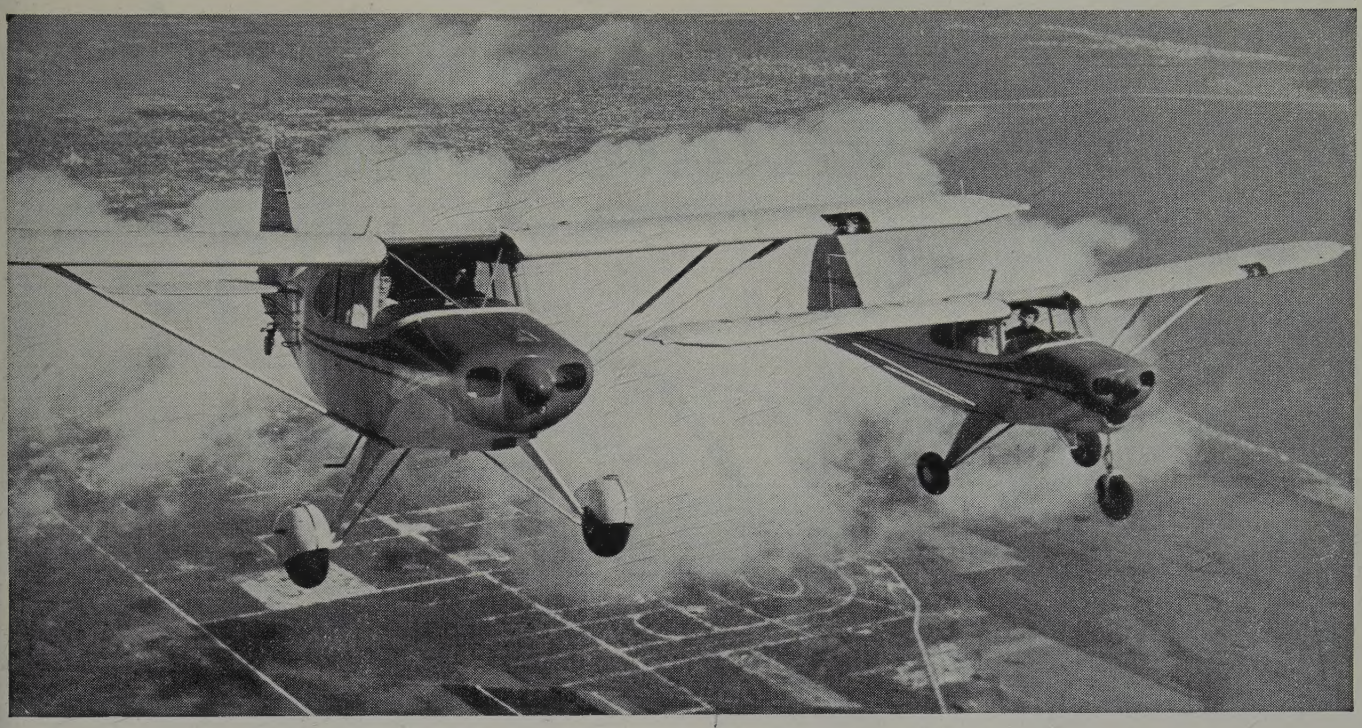

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